STP Maths 9 Answers

Answers are supplied to questions asking for estimates but there is no 'correct' estimate; we have given a likely value. Allow a reasonable margin of error for answers read from graphs.

Possible answers are given to questions asking for opinions or reasons or interpretation; any reasonable alternative is also valid.

Summary of Years 7 and 8

Revision exercise 1 (p 15)

1 **a** $1\frac{13}{24}$ **b** $\frac{7}{10}$ **c** 1 **d** $1\frac{17}{48}$ **e** $\frac{11}{12}$ **f** $1\frac{3}{4}$ **g** $2\frac{1}{5}$ **h** $\frac{71}{126}$ **i** $1\frac{23}{42}$

2 **a** $\frac{13}{36}$ **b** $\frac{1}{36}$ **c** $\frac{7}{30}$ **d** $\frac{1}{20}$ **e** $1\frac{1}{40}$ **f** $3\frac{5}{18}$ **g** $2\frac{11}{12}$ **h** $\frac{1}{8}$ **i** $\frac{31}{40}$

3 **a** $\frac{5}{9}$ **b** $\frac{1}{10}$ **c** $\frac{10}{21}$ **d** $\frac{4}{7}$ **e** $\frac{3}{22}$ **f** 2 **g** $\frac{14}{81}$ **h** $\frac{12}{49}$ **i** $4\frac{1}{2}$

4 **a** $\frac{7}{30}$ **b** $\frac{13}{21}$ **c** $2\frac{1}{4}$ **d** $\frac{2}{3}$ **e** $\frac{1}{4}$ **f** $4\frac{7}{10}$ **g** $2\frac{5}{6}$ **h** $1\frac{5}{7}$ **i** $\frac{2}{5}$ **j** $1\frac{1}{2}$ **k** $\frac{2}{3}$ **l** $3\frac{1}{12}$

5 **a** 5.01 **b** 19.1 **c** 6.17 **d** 8.9 **e** 4.832 **f** 0.00202 **g** 3.2 **h** 0.08 **i** 0.49 **j** 0.361 **k** 1.83 **l** 0.0068

6 **a** 0.96 **b** 0.042 **c** 0.008 **d** 0.25 **e** 3.35511 **f** 0.36072 **g** 2.7 **h** 0.08 **i** 0.15 **j** 0.214 **k** 0.02 **l** 0.001

7 **a** 4.2 **b** 2.8 **c** 0.02244 **d** 0.648 **e** 0.7104 **f** 1.3 **g** 0.043 **h** 2.4 **i** 0.036 **j** 0.0364

Revision exercise 2 (p 17)

1 **a** **i** 0.36 **ii** 0.95 **iii** 0.54 **iv** 0.825
b **i** $\frac{17}{20}$ **ii** $\frac{21}{50}$ **iii** $\frac{13}{20}$ **iv** $\frac{1}{8}$
c **i** 44% **ii** 28% **iii** 138% **iv** 92.5%

2 **a** 85%, 0.85 **b** $\frac{3}{8}$, 0.375 **c** $\frac{5}{8}$, 62.5% **d** $\frac{23}{400}$, 0.0575 **e** $\frac{23}{20}$, 115% **f** 475%, 4.75

3 **a** **i** $<$ **ii** $>$ **iii** $<$ **iv** $>$
b **i** $\frac{17}{7}$ **ii** $\frac{49}{9}$ **iii** $\frac{18}{5}$ **iv** $\frac{39}{4}$
c **i** $8\frac{2}{5}$ **ii** $4\frac{1}{4}$ **iii** $6\frac{4}{7}$ **iv** $1\frac{9}{17}$

4 **a** **i** 18 kg **ii** 19.8 g **iii** 12.6 m
b **i** £696 **ii** £144 **iii** 234 cm^2 **iv** £28.60
c **i** 17.0 km **ii** 0.599 m **iii** 33.1 mm
d **i** 20% **ii** $\frac{13}{40}$ **iii** 0.56% **iv** $\frac{3}{16}$

5 **a** **i** 2 : 3 **ii** 1 : 2 : 3 **iii** 2 : 3 **iv** 7 : 5 **v** 3 : 5 : 4 **vi** 18 : 8 : 9
b **i** 9 : 2 **ii** 2 : 5 **iii** 17 : 60 **iv** 2 : 125 **v** 9 : 20 **vi** 50 : 3
c **i** $1\frac{1}{9}$ **ii** $\frac{3}{7}$ **iii** $7\frac{1}{2}$ **iv** $1\frac{3}{7}$ **v** 24 **vi** 22.5
d **i** £20, £25
ii 54 m, 42 m
iii 0.625 kg, 1.25 kg, 3.125 kg
iv 30 min, $2\frac{1}{2}$ h, 4 h

6 **a** 1 : 10 000
b 4 cm

7 **a** £24.50
b **i** $\frac{3}{7}$ **ii** £25.68

8 **a** $\frac{16}{25}$
b **i** 36% **ii** 0.36 **iii** $\frac{9}{25}$

9 estimate: 4 or 5; actual value: 4.85 (to 2 d.p.)

10 **a** $\frac{21}{50}$ **b** 12% **c** 0.46 **d** 1485

11 **a** **i** £24 **ii** 25.5 cm **iii** 24 kg
b $\frac{3}{4}$ of 5
c $\frac{3}{5}$ of $\frac{9}{10}$

Revision exercise 3 (p 19)

1 **a** 625 **b** 139 **c** 5280 **d** 24000 **e** 56 **f** 7 **g** 192 **h** 4769 **i** 29 **j** 20 r 9 **k** 17 **l** 14 r 17

2 **a** **i** 64 **ii** 243 **iii** 504
b **i** 2^7 **ii** 7^3 **iii** 5^4 **iv** 3^6
c **i** $2^3 \times 5 \times 3^3$
ii $2^2 \times 3^2 \times 7 \times 13$
iii $2^3 \times 5^2 \times 3^2$

3 **a** **i** 21 **ii** 18 **iii** 40 **iv** 12 **v** 78 **vi** 20
b **i** 2 **ii** 3 **iii** 11 **iv** 3 **v** 8 **vi** 14

4 **a** 25 **b** 81 **c** 32 **d** 125 **e** 144 **f** 1600 **g** 864 **h** 2744 **i** 325 **j** 8010 **k** 720 **l** 1 100 000

5 **a** 2^7 **b** not possible **c** 5^4 **d** 2^5 **e** 7^1 **f** 3^4 **g** 3^3 **h** 2^6 **i** 5^6

6 **a** $\frac{1}{2}$ **b** $\frac{1}{10}$ **c** 3 **d** $1\frac{1}{2}$ **e** $\frac{1}{8}$ **f** $\frac{1}{36}$ **g** 125 **h** 36 **i** $\frac{1}{16}$ **j** $12\frac{1}{4}$ **k** $123\frac{37}{81}$ **l** 1

7 **a** **i** 2.65×10^2 **iii** 7.67×10^4 **v** 4.5×10^5
ii 1.8×10^{-1} **iv** 7×10^{-6} **vi** 9.2×10^{-2}
b **i** 0.0345 **iii** 0.73 **v** 140 000
ii 0.0501 **iv** 0.000 637 **vi** 283 000

8 **a** **i** 2.785 **ii** 2.78
b **i** 0.157 **ii** 0.157
c **i** 0.073 **ii** 0.0733
d **i** 0.151 **ii** 0.151
e **i** 254.163 **ii** 254
f **i** 7.820 **ii** 7.82
g **i** 3.299 **ii** 3.30
h **i** 0.001 **ii** 0.000 926
i **i** 0.010 **ii** 0.009 64

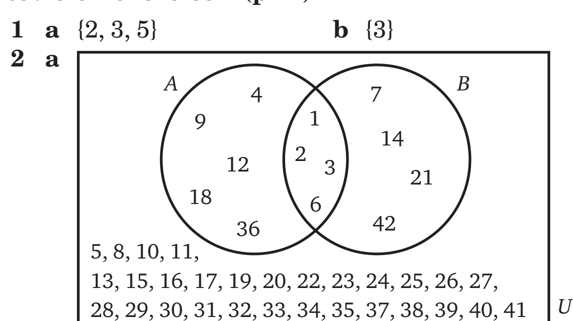
9 **a** 41.3 **d** 132 **g** 3.11
b 239 000 **e** 29.2 **h** 40.2
c 2.08 **f** 61.7 **i** 0.113

10 **a** (number line: filled circle at 7.5, open circle at 8.5)
7.5 8.5
b (number line: open circle at 14, filled circle at 15)
14 15
c (number line: filled circle at 123, open circle at 124)
123 124

Revision exercise 4 (p 21)

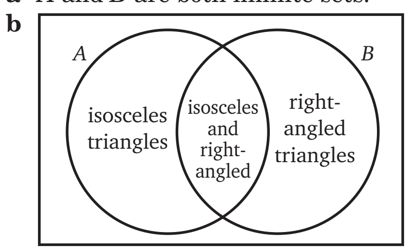
1 **a** {2, 3, 5} **b** {3}

2 **a**



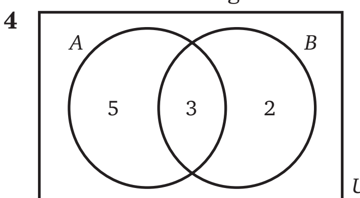
b **ii** $A \cup B$ = {1, 2, 3, 4, 6, 7, 9, 12, 14, 18, 21, 36, 42}
iii $A \cap B$ = {1, 2, 3, 6}
c 29

3 **a** A and B are both infinite sets.
b



c isosceles triangles that are also right-angled

4



Number of members in A ∪ B is 10

Revision exercise 5 (p 21)

1 **a** $p = 70°, q = 110°$ **c** $p = 50°$
b $x = 70°$ **d** $x = 27°$

2 **a** **i** 24° **ii** 18°
b **i** 135° **ii** 160°
c **i** 24 **ii** 20
d **i** yes, 9 sides
ii no
e **i** yes, 6 sides
ii yes, 18 sides

3 **a** 20 cm² **c** 17 cm²
b 10 cm² **d** 19.35 cm²

4 **a** 12 sq units **d** 16 sq units
b 30 sq units **e** 24.5 sq units
c 12 sq units

5 **a** 4 cm
b 4.5 cm²
c 5 cm
d 5 m, 25 m²
e 4 cm

6 **a** 60 cm² **b** 40 cm² **c** 30 cm²

7 **a** **i** 4.804 m **ii** 1015.96 g **iii** 116 inches
b **i** 4.5 cm **vii** 6000 cm²
ii 560 m **viii** 432 sq inches
iii 4 feet **ix** 5 cm³
iv 39 feet **x** 2000 cm³
v 500 mm² **xi** 4 m³
vi 0.4 m² **xii** 720 cubic inches

8 **a** **i** 50.3 cm **ii** 201 cm²
b **i** 35.7 cm **ii** 54.4 cm²
c **i** 65.1 cm **ii** 69.3 cm²

9 **a** 2025 cm³
b 900 cm³
c 2262 cm³ (to the nearest cm³)

10 **a** 23.94 cm³ **c** 5 cm
b 1130 cm³ **d** 1447.5 g

11 **a** 2.79 m
b 25.2 mm
c **i** 5.19 cm **ii** 6.09 cm

12 **a** (5, 5)
b 10

Revision exercise 6 (p 24)

1 **a** $5x + 21$ **e** $2x - 6$ **i** $-10x - 35$
b $3a - 2$ **f** $6a - 3$ **j** $a + 20$
c $10x + 1$ **g** $6 - 3x$ **k** $4x + 6$
d $2x - 6$ **h** $6x - 8$ **l** 18

2 **a** $24abc$
b $40x^2y$
c $60ab^2$
d $\frac{7a}{15}$
e $\frac{2}{3}$
f $\frac{50x^2}{9}$
g $6a^2$
h $\frac{x}{y}$
i -4

3 **a** **i** 4 **ii** −14 **iii** −4
b **i** 1.5 **ii** −8 **iii** 18

4 **a** $C = 6x$ **b** $u_n = 3n + 1$

5 **a** 5 **b** 4 **c** 2 **d** 10 **e** 3 **f** −5.5 **g** 32 **h** $\frac{5}{3}$ **i** 7 **j** 14

6 **a** **i** $x < 10$ **ii** $x \leqslant 5$ **iii** $x > -5$ **iv** $x \leqslant 4$ **v** $x > -6$ **vi** $x > -4$ **vii** $x > \frac{5}{4}$ **viii** $x \geqslant \frac{1}{5}$ **ix** $x \leqslant 1$
b **i** $x < 8, x > 1, 1 < x < 8$
ii $x > 2, x < 4, 2 < x < 4$
c **i** $2 < x < 4$ **ii** $-4 < x \leqslant 2$ **iii** $x < -1$

7 **a** $x = 3, y = 1$ **b** $x = 4, y = 3$ **c** $x = 2, y = 5$ **d** $x = 3, y = -3$ **e** $x = 19, y = -2$ **f** $a = 3, b = 1$

8 **a** ±4.80 **b** ±0.686

Revision exercise 7 (p 26)

1 **a** C
b D
c A, B, E
d none

2 (3, 1), scale factor 3

3 **a** **i** 3, 0 **ii** 2, 6 **iii** $-\frac{1}{2}, 3$
b **i** $y = 4x + 2$ **ii** $y = 4x - 3$
c $a = 1, b = -1$

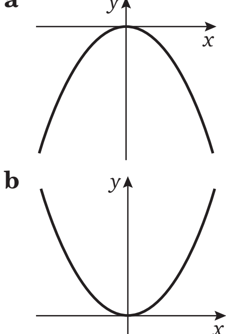
4 $y = 2x + 2$

5 **a** obtuse **b** obtuse **c** acute **d** acute

6 **a** neither
b parallel
c perpendicular
d perpendicular

7 C

8 **a**, **b**



Revision exercise 8 (p 27)

1 **a** $\frac{19}{40}$
b £18
c 37.5%

2 **a** mode 8, median 9, range 6
b 9.62

3 **a** $\frac{7}{20}$
b $\frac{7}{10}$
c $\frac{9}{20}$

4 **a**

2nd dice \ 1st dice	1	2	3	4	5	6
1	(1, 1)	(2, 1)	(3,1)	(4, 1)	(5, 1)	(6, 1)
2	(1, 2)	(2, 2)	(3, 2)	(4, 2)	(5, 2)	(6, 2)
3	(1, 3)	(2, 3)	(3, 3)	(4, 3)	(5, 3)	(6, 3)
4	(1, 4)	(2, 4)	(3, 4)	(4, 4)	(5, 4)	(6, 4)
5	(1, 5)	(2, 5)	(3, 5)	(4, 5)	(5, 5)	(6, 5)
6	(1, 6)	(2, 6)	(3, 6)	(4, 6)	(5, 6)	(6, 6)

b 10
c 30

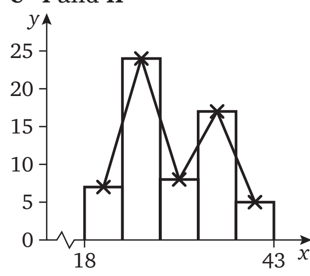
5 **a** $\frac{5}{12}$
b $\frac{1}{4}$
c $\frac{2}{3}$
d $\frac{1}{3}$

6 **a** no correlation
b moderate negative correlation
c strong positive correlation

7 **a** **i** 42 cm
ii 20 cm
b

h	f
$18 < h \leqslant 23$	7
$23 < h \leqslant 28$	24
$28 < h \leqslant 33$	8
$33 < h \leqslant 38$	17
$38 < h \leqslant 43$	4

c **i** 29
ii 39
d $23 < h \leqslant 28$
e **i** and **ii**



8 **a** 36
b 100 seconds
c yes (18 out of 36)
d not possible to say; 36 were timed but more may have run

Chapter 1 Travel graphs

Exercise 1a (p 31)

1 **a** 90 km **b** 2 h **c** 45 km
2 **a** 140 m **b** 5 h **c** 28 m
3 **a** 30 km **b** 3 h **c** 10 km
4 **a** 16 m **c** 2.67 m (to 2 d.p.)
b 6 s
5 **a** 10 m **b** 8 s **c** 1.25 m

Exercise 1b (p 33)

6 **a** $7\frac{1}{2}$ km **b** $11\frac{1}{4}$ km
7 **a** $7\frac{1}{2}$ km **b** $12\frac{1}{2}$ km
8 **a** 105 miles **b** $43\frac{3}{4}$ miles
9 **a** 2 miles **b** 14 miles
10 **a** 800 km **b** 1100 km
11 **a** 48 km **b** 84 km **c** 54 km
12 **a** 1200 miles **b** 1650 miles
13 **a** 90 km **b** 135 km
14 **a** 9 miles **b** 15 miles
15 **a** 52.5 m **b** 89.25 m
16 **a** 32 miles **b** 38 miles
17 **a** 1755 miles **b** 4185 miles
18 **a** 30 laps **b** 72 laps

Exercise 1c (p 35)

1 **a** 2 h **b** 3 h
2 **a** 5 h **b** $3\frac{1}{4}$ h
3 **a** 30 min **b** $1\frac{1}{4}$ h
4 **a** $2\frac{1}{2}$ h **b** $5\frac{1}{3}$ h
5 **a** $1\frac{1}{2}$ h **b** 5 h
6 **a** $1\frac{1}{2}$ h **b** $4\frac{1}{2}$ h
7 **a** 25 s **b** 200 s (3 min 20 s)
8 **a** 24 min **b** 54 min
9 **a** 302 h (12 days 14 h) **b** 176 h (7 days 8 h)
10 **a** $1\frac{1}{4}$ h **b** $2\frac{3}{4}$ h
11 **a** $2\frac{1}{2}$ h **b** $5\frac{1}{3}$ h
12 **a** 45 min **b** $3\frac{1}{4}$ h

Exercise 1d (p 36)

1 80 km/h
2 60 km/h
3 60 mph
4 120 mph
5 20 m/s
6 45 m/s
7 50 km/h
8 65 km/h
9 35 mph
10 8 mph
11 36 m/s
12 17 m/s
13 80 km/h
14 90 km/h
15 64 km/h
16 120 km/h
17 12 km/h
18 8 km/h
19 18 km/h
20 18 km/h
21 54 mph
22 54 mph
23 60 mph
24 105 mph
25 51.7 km/h (to 1 d.p.)
26 43 km/h
27 80 km/h
28 42.7 km/h (to 1 d.p.)
29 80 km/h
30 90 km/h
31 50 km/h

Exercise 1e (p 39)

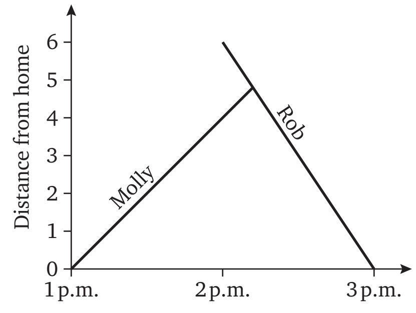
1 9 km/h
2 10 mph
3 7 mph
4 7 mph
5 75 km/h
6 125.5 km/h
7 3 knots

Exercise 1f (p 40)

1 **a** **i** 1215 **ii** 1348 **iii** 1445
b $2\frac{1}{2}$ h
c **i** 1 h 15 min **ii** 1 h 15 min
d 64 km/h
2 **a** **i** 90 km **ii** 50 km
b 5 h
c 28 km/h
d 28 km
e **i** 42 km **ii** 48 km
3 **a** 45 km
b 1 h 30 min
c 30 km/h
d 1 h
e 45 km/h
f 36 km/h
4 **a** **i** at B **ii** at B
b **i** 80 km/h **ii** 64 km/h
c 30 min
d 2 h 45 min
e 58.2 km/h (including the stop)
5 **a** $7\frac{1}{2}$ miles
b 3 times
c 45 min
d 1 h 45 min
e 2 h 30 min
f 3 mph
g the third stage
h the first and last stages
6 **a** 150 miles
b 2 h
c 75 mph
d 1 h
e 1330; $2\frac{1}{2}$ h
f 60 mph
7 **a** 55 miles
b 45 min
c 55 mph
d 36.7 mph (to 3 s.f.)
8 **a** **i** 0830 **ii** 1330
b 5 h
c 1 h 30 min
d 4 km/h
e 7 h
9 **a** 78.3 km/h (to 1 d.p.); 1430
b 100 km/h; 1354
c 1410; 26 km from B
d 52 km

10 **a** Andrew
b Andrew
c Kate
d Kate
e Tom
f Kate set off for home straight away.
g Tom

11



a 1.25 miles from Cornforth at 2:12 p.m.
b about 0.3 miles

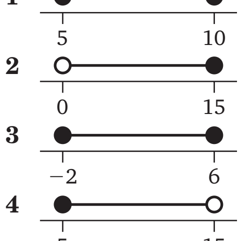
Exercise 1g (p 49)

1 **a** 21.9 km (to 1 d.p.)
b 1 h 36 min
2 **a** 14 h **b** 57 h
3 80 km/h
4 57.3 mph (to 1 d.p.)
5 5 mph
6 **a** 15 km **c** 10 min **e** 45 km/h
b 1 h 40 min **d** 9 km/h **f** 11 km

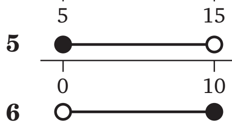
Chapter 2 Working with numbers

Exercise 2a (p 52)

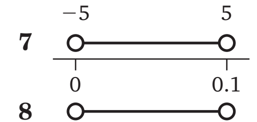
1, **2**, **3**, **4**



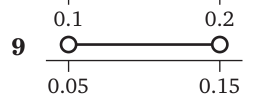
5, **6**



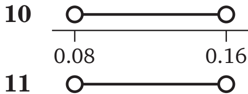
7, **8**



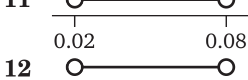
9



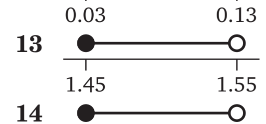
10, **11**



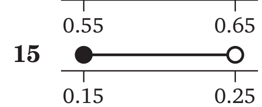
12



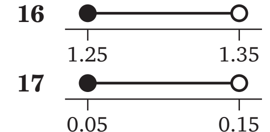
13, **14**



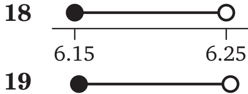
15, **16**



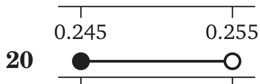
17, **18**



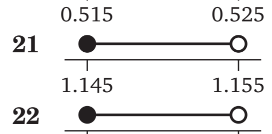
19



20



21, **22**



23

12.255 12.265

24 (number line: filled circle at 0.045, open circle at 0.055)
0.045 0.055

25 $5.55 \leqslant w < 5.65$
26 $5350 \leqslant x < 5450$
27 $12.45 \leqslant x < 12.55$
28 $74\,500 \leqslant x < 75\,500$ (whole number values only). Accept any reasonable answer for the second part of the question.
29 $1.245 \leqslant d < 1.255$
30 **a** $1.55 \leqslant x < 1.65$ **b** perhaps
c not accurate enough for measuring the space for a new cupboard
31 $452.5 \leqslant x < 457.5$
32 97.5 m
33 395 g ⩽ weight of pack < 405 g
34 **a** 2985 cm ⩽ length < 2995 cm **b** 10 cm
35 276 mm
36 33.5 mm ⩽ cube side < 34.5 mm and 34.15 mm ⩽ box side < 34.25 mm, so the cube may be larger than the box
37 364 days or 365 days for a leap year
38 249 mm ⩽ remaining section < 251
39 **a** 118 mm **b** £1 073 800
40 **a** The scale shows that one nail has weight between 7.5 g and 8.5 g.
b 7.75 g

Exercise 2b (p 57)

1 $\frac{1}{4}$
2 2
3 $2\frac{1}{2}$
4 $\frac{1}{10}$
5 8
6 $3\frac{2}{3}$
7 $\frac{1}{100}$
8 $4\frac{1}{2}$
9 $\frac{4}{15}$
10 4
11 $\frac{5}{16}$
12 $\frac{5}{8}$
13 $1\frac{1}{3}$
14 2
15 $\frac{5}{8}$
16 $6\frac{1}{4}$
17 $\frac{14}{81}$
18 $\frac{2}{3}$
19 $\frac{12}{49}$
20 $\frac{1}{18}$
21 $4\frac{1}{2}$
22 $\frac{13}{30}$
23 $\frac{69}{112}$
24 $\frac{8}{25}$
25 $2\frac{1}{18}$
26 $5\frac{3}{10}$
27 $\frac{57}{110}$
28 $4\frac{23}{42}$
29 $\frac{7}{20}$
30 $-\frac{1}{2}$
31 $3\frac{7}{12}$
32 $3\frac{3}{140}$
33 14
34 7
35 $\frac{9}{50}$
36 $1\frac{2}{25}$
37 $\frac{2}{5}$
38 $\frac{22}{63}$
39 $\frac{1}{14}$
40 $\frac{21}{68}$
41 $1\frac{1}{4}$
42 2

Exercise 2c (p 59)

1 $\frac{7}{20}$
2 $\frac{27}{125}$
3 $\frac{51}{250}$
4 $1\frac{9}{25}$
5 $\frac{3}{100}$
6 $\frac{3}{250}$
7 $\frac{1}{200}$
8 $1\frac{1}{100}$
9 $\frac{11}{100}$
10 $2\frac{1}{20}$
11 $1\frac{13}{125}$
12 $\frac{1}{10\,000}$
13 0.15
14 0.125
15 0.6
16 0.24
17 0.0625
18 0.54
19 1.75
20 0.15625
21 0.16
22 0.3125
23 2.375
24 0.002

Exercise 2d (p 60)

1 $0.\dot{3}$
2 $0.\dot{2}$
3 $0.8\dot{3}$
4 $0.0\dot{6}$
5 $0.\dot{1}4285\dot{7}$
6 $0.08\dot{3}$
7 $0.\dot{0}\dot{9}$
8 $0.0\dot{5}$
9 $0.41\dot{6}$
10 $0.0\dot{7}1428\dot{5}$
11 $0.2\dot{3}$
12 $0.\dot{0}7692\dot{3}$
13 **a** $\frac{5}{9}$
b $\frac{1}{45}$ **c** $\frac{1}{18}$ **d** $\frac{1}{225}$
14 **a** $\frac{9}{9}$ **b** 1 **c** $\frac{1}{10}$

Exercise 2e (p 61)

1 **a** 8.4×10^5 **c** 1.54×10^{-4} **e** 3.2×10^2
b 1.08×10^{10} **d** 1.15×10^{-5} **f** 7.8×10^{-2}
2 **a** 2×10^3
b 3×10^{-2}
c 1.4×10^{-5}
d 3×10^0
3 **a** 3.2×10^3
b 3.2×10^{-2}
c 3.31×10^5
d 4.13×10^{-3}
4 1.49×10^{-10}
5 2.23×10^{-3}

Chapter 3 Probability

Exercise 3a (p 64)

1 mutually exclusive
2 **a** mutually exclusive
b independent
3 **a** independent
b mutually exclusive
4 **a** mutually exclusive
b independent
5 **a** mutually exclusive
b independent
6 **a** independent
b dependent

Exercise 3b (p 66)

1 **a** $\frac{1}{26}$ **b** $\frac{1}{26}$ **c** $\frac{1}{13}$
2 **a** $\frac{1}{6}$ **b** $\frac{1}{3}$ **c** $\frac{1}{2}$
3 **a** $\frac{1}{6}$ **b** $\frac{1}{6}$ **c** $\frac{1}{3}$
4 **a** $\frac{74}{117}$ ignoring the chance that it is in a pocket in a garment in the car!)
b $\frac{43}{117}$
5 **a** $\frac{4}{7}$ **b** $\frac{11}{14}$ **c** $\frac{1}{14}$
6 **a** $\frac{32}{63}$ **b** $\frac{17}{36}$ **c** $\frac{191}{252}$ **d** $\frac{61}{252}$
7 $\frac{19}{45}$
8 **a** $\frac{1}{2}$ **b** $\frac{1}{2}$ **c** $\frac{5}{6}$
because 2 is both even and prime

Exercise 3c (p 68)

1 $\frac{1}{4}$
2 $\frac{1}{36}$
3 **a** $\frac{1}{4}$ **b** $\frac{3}{4}$ **c** $\frac{9}{16}$
4 **a** $\frac{6}{25}$ **b** $\frac{6}{25}$
5 **a** $\frac{1}{2}$ **b** $\frac{1}{4}$ **c** $\frac{1}{4}$
6 **a** $\frac{2}{3}$ **b** $\frac{3}{4}$ **c** $\frac{1}{6}$
7 **a** $\frac{3}{10}$
b not independent (you cannot eat the same sweet twice)

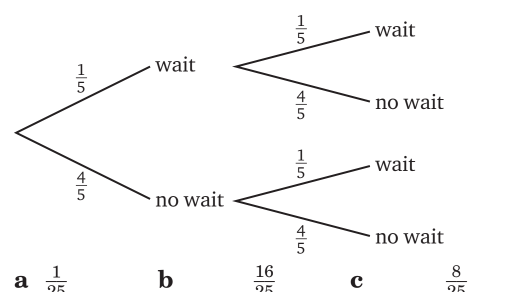
Exercise 3d (p 69)

1 **a** $\frac{1}{3}$ **b** $\frac{1}{3}$ **c** $\frac{1}{36}$ **d** $\frac{1}{4}$
2 **a** $\frac{1}{13}$ **b** $\frac{1}{26}$ **c** $\frac{3}{26}$
3 **a** $\frac{1}{3}$ **b** $\frac{5}{6}$
4 0.54
5 **a** $\frac{2}{13}$ **b** $\frac{2}{13}$ **c** $\frac{1}{169}$

Exercise 3e (p 71)

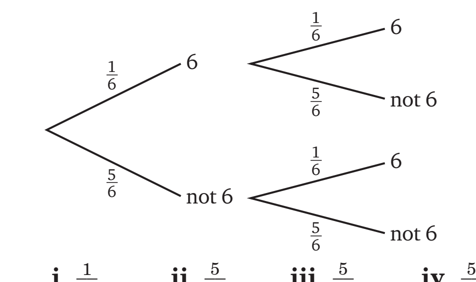
1 **a** $\frac{2}{5}$ **c** $\frac{7}{20}$ **d** $\frac{3}{40}$
2 **a** 0.8 **c** 0.04 **d** 0.64
3 **b** $\frac{2}{5}$ **c** $\frac{2}{15}$

4



a 0.35 **b** 0.15 **c** 0.15 **d** 0.35

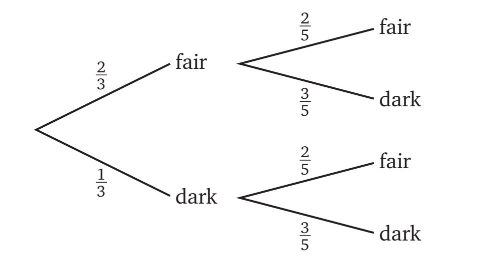
5



a $\frac{1}{25}$ **b** $\frac{16}{25}$ **c** $\frac{8}{25}$

6 **a** **i** $\frac{1}{6}$ **ii** $\frac{5}{6}$

b



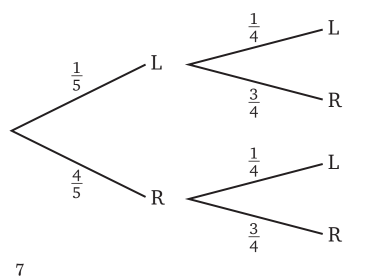
i $\frac{1}{36}$ **ii** $\frac{5}{36}$ **iii** $\frac{5}{36}$ **iv** $\frac{5}{18}$

7 Girls Boys

fair (2/3) → fair (2/5), dark (3/5); dark (1/3) → fair (2/5), dark (3/5)

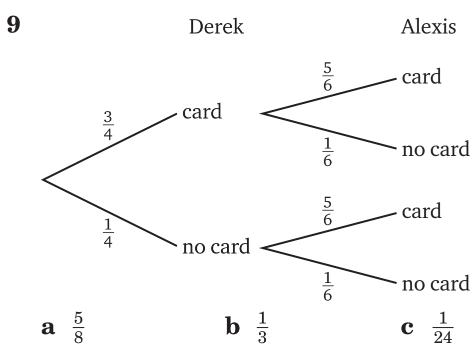
$\frac{8}{15}$

8



$\frac{7}{20}$

9



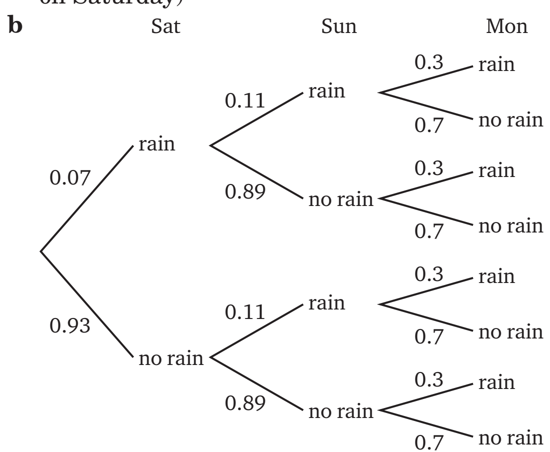
a $\frac{5}{8}$ **b** $\frac{1}{3}$ **c** $\frac{1}{24}$

1 because these outcomes cover all possibilities, i.e. they are exhaustive.

10 a $\frac{1}{8}$ **b** $\frac{1}{8}$ **c** $\frac{3}{8}$

11 a Sunday, because P(rain on Sunday) > P(rain on Saturday)

b



c i 0.0077 **ii** 0.1646

d i 0.57939 **ii** 0.42061

12 a $\frac{3}{8}$ **b** $\frac{3}{8}$ **c** $\frac{7}{8}$ **d** $\frac{1}{2}$

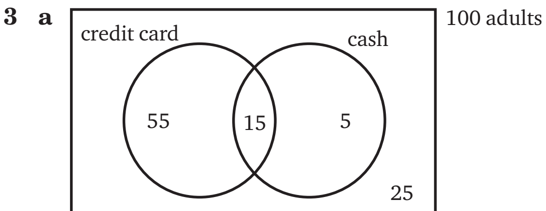
13 a 0.04875 **b** 0.04375

Exercise 3f (p 76)

1 a $\frac{4}{15}$ **b** $\frac{4}{5}$

2 a 3 **b** $\frac{2}{15}$ **c** $\frac{23}{30}$

3 a



b 25 **c** $\frac{1}{20}$ **d** $\frac{4}{5}$

4 3

5 a $\frac{11}{24}$ **b** $\frac{13}{24}$ **c** $\frac{19}{24}$

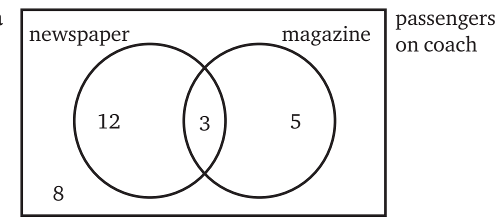
6 a $\frac{41}{50}$ **b** $\frac{2}{5}$ **c** $\frac{29}{50}$

7 a 13 **b** $\frac{3}{35}$

8 b $\frac{19}{28}$ **c** $\frac{9}{28}$ **d** $\frac{23}{28}$

9 a 4 **b** $\frac{23}{32}$ **c** $\frac{17}{32}$

10 a



b 28 **c** $\frac{5}{7}$

11 b 5 **c** $\frac{29}{78}$ **d** $\frac{65}{78}$

12 b $\frac{19}{36}$ **c** $\frac{1}{9}$ **d** $\frac{5}{12}$

13 a 1, 2, 3, 4, 5, 6

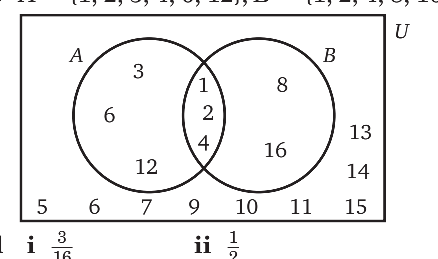
b i 2, 3, 5 **ii** 2, 4, 6

c $\frac{1}{6}$

14 a $S = \{1, 2, 3, \ldots 16\}$

b $A = \{1, 2, 3, 4, 6, 12\}$, $B = \{1, 2, 4, 8, 16\}$

c



d i $\frac{3}{16}$ **ii** $\frac{1}{2}$

15 a $x + 8$

b $2x + 3 + x + 5 + x - 5 = 43$, i.e. $4x + 3 = 43$

c i $\frac{20}{43}$ **ii** $\frac{10}{43}$

Exercise 3g (p 80)

1 a $\frac{4}{11}$ **b** $\frac{4}{11}$

2 a 0 **b** 1

3 a $\frac{1}{4}$ **b** $\frac{1}{4}$ **c** $\frac{1}{4}$

4 a $\frac{3}{32}$ **b** $\frac{15}{32}$ **c** $\frac{7}{16}$

5 a $\frac{4}{15}$ **b** $\frac{1}{5}$ **c** $\frac{2}{5}$

6 a $\frac{4}{63}$ **b** $\frac{2}{9}$ **c** $\frac{5}{9}$ **d** $\frac{8}{21}$

7 a 23 **b** $\frac{1}{25}$

Chapter 4 Percentages

Exercise 4a (p 84)

1 25%
2 30%
3 25%
4 10%
5 20%
6 20%
7 15%
8 24%
9 £56.00
10 £142.08
11 £60.90
12 £18.00
13 £27.00
14 £80.00
15 £3.20
16 £5.60
17 £6.75
18 £18.50
19 £10.00
20 **b** by £4
21 **b** by £1.70
22 same
23 £108
24 £75.52
25 £9.87
26 £142.50
27 £2106
28 £23.70

Exercise 4b (p 86)

1 £1000
2 £1600
3 £1300
4 £2500
5 £1290
6 £1652
7 £3300
8 £2000
9 £4000
10 £7680
11 £1200
12 £1610
13 £1770
14 £2112
15 £4270
16 **a** £7510 **b** £7595.60 **c** £10 210
17 **a** £6891 **b** £6976.60 **c** £9591
18 **a** £8515 **c** £8641
b £6683 **d** £109 530

Exercise 4c (p 88)

1 £28
2 £92
3 £49.60
4 £58
5 £65.60
6 £38.25
7 £16.15
8 £14.30
9 £32.25
10 **a** £12.26 **b** £14.87
11 loses 31 p

Exercise 4d (p 90)

1 £70
2 £40
3 £16
4 £6
5 £32
6 £800
7 £448
8 £20
9 £40
10 £80
11 £200
12 £17.91
13 £13.60
14 £50
15 £160
16 £17
17 £160
18 £2000
19 £210.91
20 £310.19
21 £433.91
22 £370.92
23 £178.54
24 £12
25 £650
26 £480
27 850 cm^3
28 25 cm
29 £1546
30 **a** £335
b £108.54

Exercise 4e (p 92)

1 £123 120
2 £13.69
3 $33\frac{1}{3}$%
4 £1200
5 £105
6 £344
7 44 275
8 **a** £7.20 **b** £6.90
9 **a** 70% **b** £32.50
10 **a** £180 **b** 150%
11 £ 75 500
12 **a** £69.99 **b** £10.50
13 **a** £154.10 **b** £161.84
14 labour £63, parts £47.50, total before VAT £149
VAT £29.80
15 £45.38
16 £671.07
17 **a** $383 **b** £2.47 **c** 43 p
18 £280
19 **a** **i** £28.80 **ii** £60.00
b **i** £55.00 **ii** £82.50
0.8; the multiplying factor that changes £*P* to £*S*, 80%
c 80%
d 20%

Exercise 4f (p 95)

1 £12.50
2 £731.25
3 £5.28
4 £425
5 £85.80
6 £373.76
7 8.5%
8 £41.28
9 £250
10 **a** £1000
b £25 000

Exercise 4g (p 96)

1 £42
2 £12.12
3 £103.88
4 £60.27
5 £10.45
6 £56.30
7 £22.73
8 £128 304
9 £76.04
10 £1792
11 Charles £15 360, David £51 840
12 **a** **i** £20 500 **ii** £11 303
b 54.8%
13 **a** **i** £6560 **ii** £4410.94
b 44.9%
14 **a** £4.30 **b** £4.80
15 **a** £3880 **b** £4500

16 **a** **i** 330 **ii** 280 **iii** 230
b **A** false, **B** true, **C** false, **D** true
17 **a** **i** 21 100 **ii** 22 261
b **i** 18 957 **ii** 17 969
18 **a** 2 **b** 4 **c** 8
19 start of 2025
20 **a** 2 **b** 9
21 **a** £(1.08)P
b £$(1.08)^2P$
c £$(1.08)^6P$
d £$(1.08)^nP$
£1079.46

Exercise 4h (p 101)

1 £322.40
2 £79.20
3 £5545.50
4 40%
5 15 km/litre
6 **a** 3816 **b** 2018

Chapter 5 Ratio and proportion

Exercise 5a (p 103)

1 25 : 24
2 **a** 3 : 2 **b** 2 : 3 **c** 3 : 5
3 **a** 2 : 3 **b** 9 : 5 **c** 21 : 23 **d** 6 : 5
4 **a** 1 : 1 **b** 1 : 2 **c** 1 : 8 **d** 1 : 1 **e** 1 : 3 **f** 1 : 8
5 **a** 1 : 9 **b** 1 : 4 **c** 4 : 9
6 1 : 1.5
7 1 : 2.4
8 1 : 0.857
9 1 : 2.73
10 1 : 0.6
11 1 : 2.63
12 1 : 1.33
13 1 : 0.75
14 1 : 1.43
15 1: 0.75
16 1 : 0.333
17 1 : 1.78
18 £38/tonne
19 18 p each
20 15 p/cm
21 72 p/20 screws
22 500 ml bottle

Exercise 5b (p 106)

1 570 ml
2 **a** 280 ml **b** 170 ml
3 600 g
4 **a** 12 : 15 : 14
b £1756.10, £2195.12, £2048.78
5 **a** James £25.21, Sarah £45.01
b £1.23

Exercise 5c (p 107)

1 **a** £2.70 **b** £10.80
2 **a** 6 units **b** $\frac{3}{4}$ unit
3 **a** 72 km **b** 118.8 km
4 **a** £1.65 **b** £7.92
5 £1.20
6 15.5 km
7 $4\frac{1}{3}$ km
8 £19.60
9 £16.60
10 1.5 p
11 1.5 m
12 5.5 cm^2

Exercise 5d (p 108)

1 3.2 litres
2 3 hours
3 **a** 12.5 units **b** 3 h 36 min
4 **a** £140 **b** $112\frac{1}{2}$ miles
5 £321.78
6 700 bottles
7 £9.28
8 66 rows
9 20.25 cm
10 64 pesos
11 65.6 km
12 **a** 2.25×10^7
b 3.6×10^7
c 1.35×10^5
13 15 volts
14 24.7 joules
15

x	2	4	6	8
y	10	20	30	40

16 33.75 p + 20.4 p + 5.5 p + 28.8 p + 83.2 p + 5 p = £1.77 (to nearest penny)

Exercise 5e (p 112)

1 5.5 hours
2 203 lines
3 12
4 8 days
5 25 cm
6 20
7 16 cm
8 48
9 49
10

p	20	5	0.5	0.01
q	0.5	2	20	1000

Exercise 5f (p 113)

1 **a** €47.25 **b** €87.50
2 £382.85
3 3.5 hours
4 not possible
5 4.46 cm
6 47
7 24
8 34
9 1.44 m
10 6 weeks
11 not possible
12 1.5 amps
13 **a** directly proportional
b neither
c inversely proportional

Exercise 5g (p 114)

1 3.6
2 114.3 km
3 6 h 40 min
4 3 kg
5 **a** 0.6 : 1 **b** 1 : 1.2
6 £7.50
7 £135
8 3.9 min

Summary 1

Revision exercise 1.1 (p 119)

1 **a** 40 km **b** 2 h 15 min **c** 17.8 km/h **d** 22 km **e** no **f** no

2 **a** **i** 30 km from Amberley **ii** 20 km from Coldham
b **i** 60 km/h **ii** 40 km/h
c 15 min
d 2 h 45 min
e 44 km/h

3 **a** **i** 108 km **ii** 24 km **iii** 120 km
b **i** 2 h **ii** 3 h 20 min
c **i** 1 h 30 min **ii** 2 h 30 min

4 **a** Bianca, Craig, Ali
b 10 km/h
c 15 km/h
d 20 km/h
e 25 km from home, 2.30 p.m.
f Ali, 10 km; Craig, 15 km; Bianca, 9 km
g 5 km

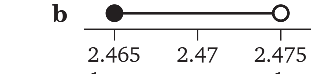
5 **a** 6 **b** $1\frac{1}{2}$ **c** $2\frac{1}{2}$

6 **a** **i** 0.35 **ii** 0.3125 **iii** 0.0025 **iv** 0.468 75
b **i** $\frac{11}{20}$ **ii** $\frac{7}{8}$ **iii** $\frac{3}{200}$ **iv** $2\frac{26}{125}$

7 **a** $0.0\dot{6}$ **b** $0.\dot{5}7142\dot{8}$ **c** $0.91\dot{6}$

8 **a** 5 **b** $\frac{5}{9}$ **c** 4.5

9 **a** $195 \leqslant n < 205$
b



10 **a** $\frac{1}{26}$ **b** $\frac{1}{26}$ **c** $\frac{1}{676}$

11 **a** $\frac{1}{8}$ **b** $\frac{21}{32}$ **c** $\frac{1}{32}$

12 **a** $\frac{1}{6}$ **b** $\frac{1}{2}$ **c** $\frac{1}{12}$

13 **b** $\frac{15}{49}$ **c** $\frac{26}{49}$

14 **b** $\frac{8}{27}$ **c** $\frac{14}{27}$

15 **a**

U; A: Q, U, A; A and B: S, H; B: C, O, L

b $\frac{9}{13}$

Revision exercise 1.2 (p 123)

1 £136
2 £39.95
3 £85
4 **a** £2029.75 **b** 16%
5 £82
6 **a** **i** 1 : 1.8 **ii** 1 : 0.8 **iii** 1 : 2.33
b **i** 1.75 : 1 **ii** 0.125 : 1 **iii** 3.67 : 1
7 **a** 4 : 3 **b** 3 : 4 **c** 3 : 7
8 **a** £19.50 **b** 200 miles
9 7 days
10 12 days

Revision exercise 1.3 (p 123)

1 **a** 40 min **b** 2 km, 24 min **c** 64 min **d** 11.25 km/h
2 **a** 34.7 cm
b $3.5\text{ m} \leqslant \text{thickness} < 4.5\text{ m}$
3 **a** $1\frac{1}{2}$ **b** $1\frac{5}{7}$ **c** $\frac{2}{3}$
4 **a** $2\frac{1}{3}$ **b** $1.\dot{7}\dot{2}$ **c** $\frac{11}{40}$
5 **a** $\frac{7}{9}$ **b** $\frac{2}{9}$
6 **a** £1748 **b** £22
7 **a** 3 weeks **b** £88 000
8 £6144
9 £592
10 10 days

Revision exercise 1.4 (p 124)

1 **a** 0.818
b £40.90; £40.91; using a corrected number for further working introduces errors
2 **a** $\frac{2}{3}$ **b** $\frac{1}{15}$ **c** $\frac{91}{150}$
3 **a** $\frac{14}{27}$ **b** $1\frac{1}{2}$ **c** $\frac{2}{3}$
4 **a** $\frac{3}{20}$ **b** $\frac{3}{8}$ **c** $\frac{21}{40}$
5 **b** $\frac{4}{15}$ **c** $\frac{23}{45}$
6 £44
7 £65
8 **a** £446.25 **b** £9415.93
9 1200
10 $\frac{1}{2}$

Mental arithmetic practice 1 (p 126)

1 3
2 16
3 $\frac{9}{10}$
4 45
5 0
6 1.95
7 0.7
8 125%
9 63
10 $2\frac{3}{20}$ or $\frac{43}{20}$
11 $\frac{1}{4}$
12 15 kg, 20 kg
13 £96
14 $\frac{1}{125}$
15 64.5 kg
16 $\frac{1}{3}$
17 2
18 0.85
19 $0.1\dot{6}$
20 $\frac{1}{8}$

21 1.96
22 2.92
23 0.125
24 3.6×10^4
25 a^2
26 145%
27 2
28 10^{-5}
29 13
30 92%
31 159.5 cm
32 $0.\dot{2}\dot{7}$
33 1.45
34 5
35 0.4
36 25
37 £16.20
38 $\frac{3}{4}$
39 200
40 10^{-2}
41 $\frac{1}{10}$
42 £1.50
43 £1540
44 $\frac{4}{3}$ or $1\frac{1}{3}$
45 60 cm^3
46 0.0325
47 £73.50
48 24%
49 $\frac{16}{25}$
50 375%
51 6×10^{-6}
52 £60
53 60.5 cm
54 $\frac{1}{2}$
55 octagon
56 $12a^2$
57 4
58 10 cm
59 36
60 51 cm^2

Chapter 6 Algebraic products

Exercise 6a (p 128)

1 $2x + 2$
2 $3x - 3$
3 $4x + 12$
4 $-3x - 6$
5 $15xy + 5xz$
6 $16xy + 12yz$
7 $6np - 10nq$
8 $-3ab + 3bc$
9 $16rt - 8rs$
10 $3ab - 15ac$
11 $12xy + 8xz$
12 $-3xy + 6xz$

Exercise 6b (p 129)

1 $ac + ad + bc + bd$
2 $ps + pt + qs + qt$
3 $2ac + 4ad + bc + 2bd$
4 $5xz + 15x + 2yz + 6y$
5 $xz - 4x + yz - 4y$
6 $ac + ad - bc - bd$
7 $xw + xz + yw + yz$
8 $6ac + 2ad + 3bc + bd$
9 $5xz + 10x + 4yz + 8y$
10 $15x - 3xz - 10y + 2yz$
11 $2ps - 3pt + 2qs - 3qt$
12 $ac - ad - 2bc + 2bd$
13 $6uw - 30ur - 5vw + 25vr$
14 $6ac - 9ad + 8bc - 12bd$
15 $9xz + 6x + 6yz + 4y$
16 $12pr - 9ps - 4qr + 3qs$
17 $9ac + 12ad - 12bc - 16bd$
18 $21x - 14xz - 6y + 4yz$
19 $10ac - 4a + 5bc - 2$b
20 $15a - 10ad - 12b + 8bd$

Exercise 6c (p 130)

1 $x^2 + 7x + 12$
2 $x^2 + 6x + 8$
3 $x^2 + 7x + 6$
4 $x^2 + 7x + 10$
5 $x^2 + 11x + 24$
6 $a^2 + 9a + 20$
7 $b^2 + 9b + 14$
8 $c^2 + 10c + 24$
9 $p^2 + 15p + 36$
10 $q^2 + 17q + 70$
11 $x^2 - 5x + 6$
12 $x^2 - 12x + 35$
13 $a^2 - 10a + 16$
14 $x^2 - 13x + 30$
15 $b^2 - 10b + 25$
16 $x^2 - 7x + 12$
17 $x^2 - 12x + 32$
18 $b^2 - 6b + 8$
19 $a^2 - 8a + 16$
20 $p^2 - 15p + 56$
21 $x^2 + x - 6$
22 $x^2 + x - 20$
23 $x^2 - 3x - 28$
24 $a^2 - 7a - 30$
25 $p^2 - 25$
26 $x^2 + 5x - 14$
27 $x^2 + x - 30$
28 $x^2 + 9x - 10$
29 $b^2 - b - 56$
30 $z^2 - 11z - 12$

Exercise 6d (p 132)

1 $x^2 + 9x + 20$
2 $a^2 + 7a + 10$
3 $x^2 - 9x + 20$
4 $a^2 - 7a + 10$
5 $x^2 + 14x + 48$
6 $a^2 + 17a + 70$
7 $x^2 - 14x + 48$
8 $a^2 - 17a + 70$
9 $a^2 - 3a - 10$
10 $y^2 - 3y - 18$
11 $z^2 - 6z - 40$
12 $p^2 - 3p - 40$
13 $a^2 - 3a - 70$
14 $y^2 + 8y - 20$
15 $z^2 - 11z - 12$
16 $p^2 - 11p - 26$

Exercise 6e (p 132)

1 $2x^2 + 3x + 1$
2 $5x^2 + 12x + 4$
3 $5x^2 + 17x + 6$
4 $3x^2 + 19x + 20$
5 $3x^2 + 5x + 2$
6 $3x^2 + 11x + 6$
7 $4x^2 + 7x + 3$
8 $7x^2 + 23x + 6$
9 $6x^2 + 13x + 6$
10 $12x^2 - 25x + 12$
11 $10x^2 - 3x - 18$
12 $21a^2 - 58a + 21$
13 $10x^2 + 31x + 15$
14 $21x^2 - 20x + 4$
15 $12x^2 - 5x - 2$
16 $6b^2 - 5b - 25$
17 $4a^2 - 9$
18 $9b^2 - 49$
19 $49y^2 - 25$
20 $20a^2 + a - 12$
21 $16x^2 - 9$
22 $25y^2 - 4$
23 $9x^2 - 1$
24 $16x^2 - 8x - 35$
25 $10 - 3x - x^2$
26 $8 + 2x - 3x^2$
27 $-1 + 2x - x^2$
28 $20 + y - y^2$
29 $21 - 4x - x^2$
30 $2 + 7x - 4x^2$
31 $-6 + 5x - x^2$
32 $20 - 2p - 4p^2$
33 $6x^2 + 5x + 1$
34 $4 + 8x - 5x^2$
35 $-3 + 19x - 6x^2$
36 $-6 + 29a - 35a^2$
37 $8 + 10x - 3x^2$
38 $15x^2 + 26x + 8$
39 $12 + 13x - 14x^2$
40 $-9 + 27x - 20x^2$
41 $12 - p - p^2$
42 $x^2 - 3x - 10$

Exercise 6f (p 134)

1 $x^2 + 2x + 1$
2 $x^2 + 4x + 4$
3 $a^2 + 6a + 9$
4 $b^2 + 8b + 16$
5 $x^2 + 2xz + z^2$
6 $y^2 + 2xy + x^2$
7 $c^2 + 2cd + d^2$
8 $m^2 + 2mn + n^2$
9 $a^2 + 18a + 81$
10 $t^2 + 20t + 100$
11 $x^2 + 24x + 144$
12 $x^2 + 16x + 64$
13 $p^2 + 14p + 49$
14 $p^2 + 2pq + q^2$
15 $a^2 + 2ab + b^2$
16 $e^2 + 2ef + f^2$
17 $u^2 + 2uv + v^2$
18 $M^2 + 2Mm + m^2$
19 $4x^2 + 4x + 1$
20 $16b^2 + 8b + 1$
21 $25x^2 + 20x + 4$
22 $36c^2 + 12c + 1$
23 $9a^2 + 6a + 1$
24 $4x^2 + 20x + 25$
25 $9a^2 + 24a + 16$
26 $16y^2 + 24y + 9$
27 $9W^2 + 12W + 4$
28 $x^2 + 4xy + 4y^2$
29 $9x^2 + 6xy + y^2$
30 $4x^2 + 20xy + 25y^2$
31 $9a^2 + 12ab + 4b^2$
32 $9a^2 + 6ab + 6^2$
33 $p^2 + 8pq + 16q^2$
34 $49x^2 + 28xy + 4y^2$
35 $9s^2 + 24st + 16t^2$
36 $9s^2 + 6st + t^2$
37 $x^2 - 4x + 4$
38 $x^2 - 12x + 36$
39 $a^2 - 20a + 100$
40 $x^2 - 2xy + y^2$
41 $x^2 - 6x + 9$
42 $x^2 - 14x + 49$
43 $a^2 - 2ab + b^2$
44 $u^2 - 2uv + v^2$
45 $9x^2 - 6x + 1$
46 $25z^2 - 10z + 1$
47 $100a^2 - 180a + 81$
48 $16x^2 - 24x + 9$
49 $4a^2 - 4a + 1$
50 $16y^2 - 8y + 1$
51 $49b^2 - 28b + 4$
52 $25x^2 - 30x + 9$
53 $4y^2 - 4xy + x^2$
54 $25x^2 - 10xy + y^2$
55 $9m^2 - 12mn + 4n^2$
56 $49x^2 - 42xy + 9y^2$
57 $a^2 - 6ab + 9b^2$
58 $m^2 - 16mn + 64n^2$
59 $25a^2 - 20ab + 4b^2$
60 $9p^2 - 30pq + 25q^2$

Exercise 6g (p 136)

1 $x^2 - 16$
2 $b^2 - 36$
3 $c^2 - 9$
4 $x^2 - 144$
5 $x^2 - 25$
6 $a^2 - 49$
7 $q^2 - 100$
8 $x^2 - 64$
9 $4x^2 - 1$
10 $9x^2 - 1$
11 $49a^2 - 4$
12 $25a^2 - 16$
13 $25x^2 - 1$
14 $4a^2 - 9$
15 $100m^2 - 1$
16 $36a^2 - 25$
17 $9x^2 - 16y^2$
18 $4a^2 - 25b^2$
19 $1 - 4a^2$
20 $49y^2 - 9z^2$
21 $100a^2 - 81b^2$
22 $25a^2 - 16b^2$
23 $1 - 9x^2$
24 $9 - 25x^2$

Exercise 6h (p 137)

1 $2x^2 + 9x + 12$
2 $2x^2 + 9x + 2$
3 $x^2 + 15x + 32$
4 $a^2 - 9a + 36$
5 $2a^2 - 10a - 3$
6 $x^2 + 13x + 25$
7 $x^2 - 2x - 21$
8 $x^2 - 2x - 23$
9 $16x^2 + 6x - 10$
10 $12x^2 + 8x - 20$
11 $x^2y^2 - 6xy + 9$
12 $25 - 10yz + y^2z^2$
13 $x^2y^2 + 8xy + 16$
14 $9p^2q^2 + 48pq + 64$
15 $a^2 - 2abc + b^2c^2$
16 $a^2b^2 - 4ab + 4$
17 $36 - 12pq + p^2q^2$
18 $m^2n^2 + 6mn + 9$
19 $u^2v^2 - 4uvw + 4w^2$

Exercise 6i (p 139)

1 $5x + 10$
2 $24pq - 16pr$
3 $6a^2 - 13ab - 5b^2$
4 $12x^2 - 17x - 5$
5 $x^2 + 16x + 60$
6 $x^2 - 20x + 96$
7 $16y^2 - 16y - 21$
8 $16y^2 - 81$
9 $25x^2 + 20x + 4$
10 $4a^2 - 28ab + 49b^2$
11 $8 - 20x$
12 $16a - 24a^2$
13 $12a^2 - 35a - 33$
14 $99 - 2x - x^2$
15 $5 - 48x - 20x^2$
16 $y^2 + 4yz + 4z^2$
17 $36y^2 + 24yz - 5z^2$
18 $16a^2 + 8a + 1$
19 $25a^2 - 70a + 49$
20 $36z^2 - 156yz + 169y^2$
21 $6 - 3a$
22 $8ab + 4ac$
23 $10ac + 25ad + 4bc + 10bd$
24 $x^2 - 19x + 84$
25 $a^2 + 16a + 63$
26 $a^2 - a - 20$
27 $6x^2 + 11x + 3$
28 $25x^2 - 4$
29 $9x^2 - 42x + 49$
30 $25x^2 - 4y^2$

Exercise 6j (p 140)

1 identity
2 equation
3 identity
4 identity
5 expression
6 identity
7 expression
8 equation

Chapter 7 Algebraic factors

Exercise 7a (p 141)

1 $4(x + 1)$
2 $3(4x - 1)$
3 $2(3a + 1)$
4 $5(a - 2b)$
5 $3(t - 3)$
6 $5(2a - 1)$
7 $4(3a + 1)$
8 $2(a + 2b)$
9 $7(2x - 1)$
10 $x(x + 2)$
11 $x(x - 7)$
12 $a(a + 6)$
13 $x(2x + 1)$
14 $2t(2 - t)$
15 $x(x + 5)$
16 $x(x - 4)$
17 $b(b + 4)$
18 $a(4a - 1)$
19 $2x(x - 3)$
20 $2z(z^2 + 2)$
21 $5a(5a - 1)$
22 $4x(3x + 4)$
23 $5b(a - 2c)$
24 $3y(y - 9)$
25 $2a(a - 6)$
26 $2p(3p + 1)$
27 $3y(3y - 2)$
28 $2(x^2 + 2x + 3)$
29 $5(2a^2 - a + 4)$
30 $b(a + 4c - 3d)$
31 $4(2x - y + 3z)$
32 $3a(3b - 2c - d)$
33 $3(x^2 - 2x + 3)$
34 $4(a^2 + 2a - 1)$
35 $x(5y + 4z + 3)$
36 $5b(a + 2c + d)$
37 $2y(x - 2z + 4w)$
38 $x^2(x + 1)$
39 $x^2(1 - x)$
40 $5a^2(4 - a)$
41 $4x^2(3x - 4)$
42 $4x^2(x^2 + 3)$
43 $a^2(1 + a)$
44 $b^2(b - 1)$
45 $2x^2(2x - 1)$
46 $9a^2(3 - 2a)$
47 $5x^2(2 - 3x^2)$
48 $4(3x + 2)$
49 $4x(2x + 3)$
50 $3(3x^2 - 2x + 4)$
51 $5x(x^2 - 2)$
52 $4q(2p + r)$
53 $x(x - 8)$
54 $3(4 + 3y^2)$
55 $4x(3y + 4z + 2)$
56 $2x(2x^2 + 3)$
57 $4bc(3a - 2d)$
58 $\frac{1}{2}h(a + b)$
59 $m(g - a)$
60 $\frac{1}{2}m(v^2 - u^2)$
61 $P\left(1 + \frac{RT}{100}\right)$
62 $\pi r(2r + h)$
63 $\pi(R^2 + r^2)$
64 $2g(h_1 - h_2)$
65 $m(\frac{1}{2}v^2 - gh)$
66 $\frac{1}{3}\pi r^2(4r - h)$
67 $\pi r(3r + 2h)$
68 $\frac{1}{2}m(u^2 + v^2)$
69 $\frac{1}{2}c(b - \frac{1}{2}a)$

Exercise 7b (p 145)

1 $(x + 2)(x + 1)$
2 $(x + 5)(x + 1)$
3 $(x + 4)(x + 3)$
4 $(x + 5)(x + 3)$
5 $(x + 20)(x + 1)$
6 $(x + 7)(x + 1)$
7 $(x + 6)(x + 2)$
8 $(x + 12)(x + 1)$
9 $(x + 15)(x + 1)$
10 $(x + 10)(x + 2)$
11 $(x + 4)^2$
12 $(x + 12)(x + 3)$
13 $(x + 18)(x + 1)$
14 $(x + 20)(x + 2)$
15 $(x + 8)(x + 1)$
16 $(x + 3)^2$
17 $(x + 18)(x + 2)$
18 $(x + 6)(x + 3)$
19 $(x + 6)(x + 5)$
20 $(x + 10)(x + 4)$

Exercise 7c (p 146)

1 $(x - 8)(x - 1)$
2 $(x - 4)(x - 3)$
3 $(x - 15)(x - 2)$
4 $(x - 7)(x - 4)$
5 $(x - 7)(x - 6)$
6 $(x - 2)(x - 3)$
7 $(x - 15)(x - 1)$
8 $(x - 3)^2$
9 $(x - 16)(x - 2)$
10 $(x - 7)(x - 9)$

Exercise 7d (p 146)

1 $(x - 3)(x + 2)$
2 $(x - 4)(x + 5)$
3 $(x - 4)(x + 3)$
4 $(x + 7)(x - 4)$
5 $(x - 3)(x + 5)$
6 $(x - 6)(x + 4)$
7 $(x + 9)(x - 3)$
8 $(x - 11)(x + 2)$
9 $(x - 7)(x + 5)$
10 $(x - 10)(x + 2)$

Exercise 7e (p 147)

1 $(x + 7)(x + 2)$
2 $(x - 7)(x - 3)$
3 $(x + 7)(x - 2)$
4 $(x + 6)(x - 5)$
5 $(x + 8)(x + 1)$
6 $(x - 5)^2$
7 $(x + 9)(x - 1)$
8 $(x - 13)(x - 2)$
9 $(x + 8)(x - 7)$
10 $(x + 2)(x + 30)$
11 $(x - 9)(x + 3)$
12 $(x + 20)(x - 4)$
13 $(x + 13)(x + 1)$
14 $(x + 14)(x - 2)$
15 $(x + 10)(x - 8)$
16 $(x - 6)(x - 5)$
17 $(x + 12)(x - 4)$
18 $(x + 12)(x + 6)$
19 $(x + 4)(x + 13)$
20 $(x - 14)(x + 2)$
21 $(x + 8)(x + 3)$
22 $(x - 14)(x + 3)$
23 $(x - 16)(x - 2)$
24 $(x - 12)(x + 5)$
25 $(x + 8)(x + 1)$
26 $(x - 3)^2$
27 $(x + 7)(x + 4)$
28 $(x + 5)(x - 4)$
29 $(x + 3)^2$
30 $(x - 8)(x - 1)$
31 $(x + 15)(x + 2)$
32 $(x + 9)(x - 3)$
33 $(x + 11)(x + 2)$
34 $(x - 13)(x + 2)$
35 $(x - 1)(x - 7)$
36 $(x + 7)(x - 6)$
37 $(x - 8)(x + 3)$
38 $(x - 7)(x - 2)$
39 $(x + 27)(x + 1)$
40 $(x + 9)(x - 7)$
41 $(x + 5)^2$
42 $(x - 5)^2$
43 $(x + 2)^2$
44 $(x - 7)^2$
45 $(x + 6)^2$
46 $(x - 6)^2$
47 $(x - 2)^2$
48 $(x + 8)^2$

Exercise 7f (p 149)

1 $(2 + x)(1 - x)$
2 $(3 - x)(2 + x)$
3 $(1 - x)(4 + x)$
4 $(4 - x)(2 + x)$
5 $(2 - x)(3 + x)$
6 $(2 - x)(1 + x)$
7 $(2 - x)(4 + x)$
8 $(1 - x)(5 + x)$
9 $(2 - x)(5 + x)$
10 $(6 - x)(2 + x)$
11 $(5 - x)(1 + x)$
12 $(2 - x)(7 + x)$
13 $(6 - x)(1 + x)$
14 $(4 - x)(5 + x)$
15 $(3 - x)(5 + x)$
16 $(4 - x)(3 + x)$

Exercise 7g (p 150)

1 $(x + 5)(x - 5)$
2 $(x + 2)(x - 2)$
3 $(x + 10)(x - 10)$
4 $(x + 1)(x - 1)$
5 $(x + 8)(x - 8)$
6 $(x + 4)(x - 4)$
7 $(x + 6)(x - 6)$
8 $(x + 9)(x - 9)$
9 $(x + 7)(x - 7)$
10 $(3 + x)(3 - x)$
11 $(6 + x)(6 - x)$
12 $(10 + x)(10 - x)$

13 $(a + b)(a - b)$
14 $(3y + z)(3y - z)$
15 $(4 + x)(4 - x)$
16 $(5 + x)(5 - x)$
17 $(9 + x)(9 - x)$
18 $(x + y)(x - y)$

Exercise 7h (p 150)

1 $3(x + 4)$
2 $5x(5x + 2)$
3 $4(3x^2 - 2)$
4 $7(2x + 3)$
5 $2(2x^2 + 1)$
6 $7(3x - 1)$
7 $9x(x - 2)$
8 $4(5x + 3)$
9 $4x(2x - 1)$
10 $3(x + 1)(x + 3)$
11 $5(x - 5)(x + 2)$
12 $4(x + 4)(x - 2)$
13 $3(x + 2)(x - 2)$
14 $2(x - 2)(x - 7)$
15 $4(x - 5)(x - 1)$
16 $3(x + 2)(x + 4)$
17 $5(x + 3)(x - 3)$
18 $3(x - 7)(x + 3)$
19 $3(2 - x)(3 + x)$

Exercise 7i (p 151)

1 7.5
2 18.5
3 17.7
4 35.04
5 31.2
6 20.4
7 12.9
8 178.97
9 1000
10 336
11 53.2
12 5.336
13 8
14 140
15 75.8
16 0.526

Exercise 7j (p 152)

1 $(x + 5)(x + 8)$
2 $(x - 9)(x - 2)$
3 $(x - 6)(x + 6)$
4 not possible
5 $(x - 6)(x - 2)$
6 not possible
7 $(x + 7)(x - 1)$
8 $(x + 15)(x - 2)$
9 $(x - 8)(x - 3)$
10 not possible
11 $(x + 15)(x - 1)$
12 $(2 - x)(14 + x)$
13 $(x + 6)(x + 2)$
14 $(x - 6)(x + 5)$
15 $(x - 7)(x + 7)$
16 not possible
17 not possible
18 $(x + 6)(x + 7)$
19 $(x - 3)(x + 3)$
20 $(x - 6)(x - 4)$
21 $(x - 4)(x + 17)$
22 $(x + 13)(x - 2)$
23 $(a - 7)(a - 9)$
24 $(7 - x)(4 + x)$

Exercise 7k (p 153)

1 **a** $10(a + 2)$ **b** $5p(3p - 2)$
2 **a** $4b(a - 2c)$ **b** $5(b^2 + 3b - 1)$
3 **a** $(a + 6)(a + 3)$ **b** $(x - 8)(x + 1)$
4 **a** $(7 + x)(3 + x)$ **b** $(5 - x)(2 - x)$
5 **a** $(a - 6)(a + 6)$ **b** $(4 - x)(4 + x)$
6 **a** 18.5 **b** 23

Exercise 7l (p 153)

1 **a** $4z^2(2z - 1)$ **b** $5y(x - 4z)$
2 **a** $a(7 - a)$ **b** $(x - 9)(x + 3)$
3 **a** $(x + 7)(x + 5)$ **b** $2(a - 4)(a + 1)$
4 **a** $(10 - x)(10 + x)$ **b** $(x - 3)(x + 3)$
5 **a** $(x + 8)(x - 1)$ **b** $(a - 7)^2$
6 **a** 12 **b** 0.286

Exercise 7m (p 153)

1 **a** $6z(2z - 1)$ **b** $4y(2x - 3z)$
2 **a** $(x + 5)^2$ **b** $(x - 6)(x + 4)$
3 **a** $(a + 3)(a - 2)$ **b** $(x + 11)(x - 4)$
4 **a** $(b - 7)(b + 7)$ **b** $p(16p - 1)$
5 **a** $(15 - x)(2 - x)$ **b** $(4 + x)(3 - x)$
6 **a** 264 **b** 358 800

Chapter 8 Organising and summarising data

Answers read from graphs will not necessarily match those given here. Allow some leeway for both the shape of the graph and the answers.

Exercise 8a (p 158)

1 **a** 17 **b** 15

2 **a** 107 cm **b** 107 cm **c** 26 cm **d** 23

Exercise 8b (p 160)

1 4.2
2 7.6 cm
3 50.5 p
4

Defective screws	0–2	3–5	6–8	9–11
Frequency	10	7	2	1

; 3.1

5 160.4 cm
6 **a** 190
b 25 min
c

Midclass value	2.5	7.5	12.5	17.5	22.5
Frequency	25	35	100	20	10

d 11.3 min (to 3 s.f.)

Exercise 8c (p 162)

1 54, 126, 188, 233, 311, 375, 420, 502
2 126, 154, 144, 175, 118
3 **a** miles: 10, 26, 54, 72, 111, 139, 154
a **i** 67 miles **ii** 101 miles
4 **a** (£) 25, 73, 81, 136, 170, 185, 190
b £190
c Thursday

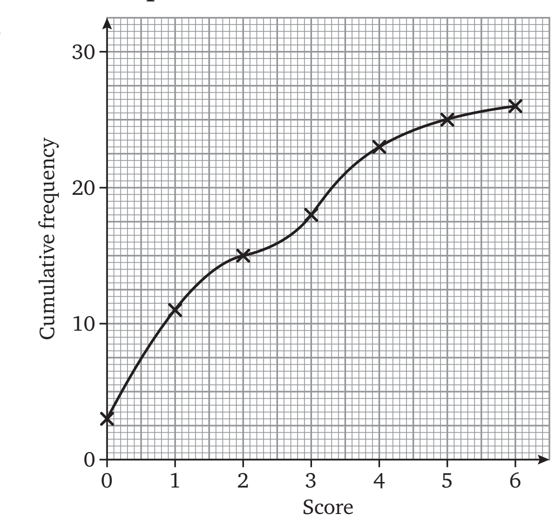
Exercise 8d (p 164)

1 Cumulative frequency: 3, 11, 15, 18, 23, 25, 26
a 26
b 11
2 Cumulative frequency: 7, 21, 39, 72, 108, 151, 172, 187, 195, 200
a 200
b 108
c 49
d No; 15 are in range 71–80 but we do not know how many of these scored 75.
e Need to know estimation of distribution within 51–60 range
3 Cumulative frequency: 8, 22, 55, 61, 66, 69, 70
a 70 **b** 55 **c** 48
4 Frequency: 77, 124, 182, 228, 164, 92, 73, 32, 22, 9
Cumulative frequency: 77, 201, 383, 611, 775, 867, 940, 972, 994, 1003
a 136 **b** 611 **c** 666
d could have been shared, as there are 9 students who sold 46−50 books

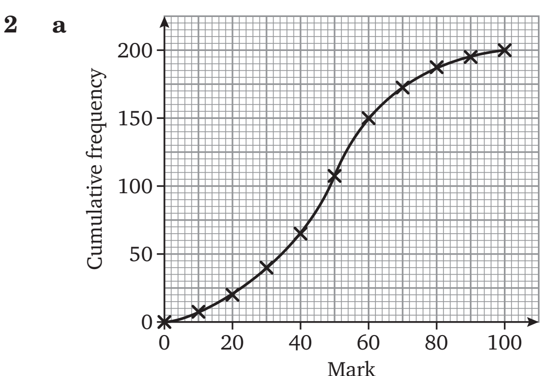
5 Frequency: 2, 4, 9, 9, 12, 15, 13, 8, 5, 8, 6, 4
a 13
b 23

Exercise 8e (p 168)

1



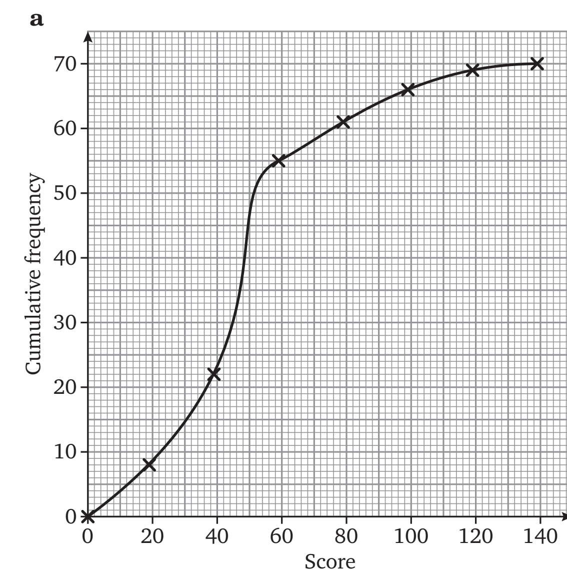
2 **a**




b 20


c 120

3 **a**

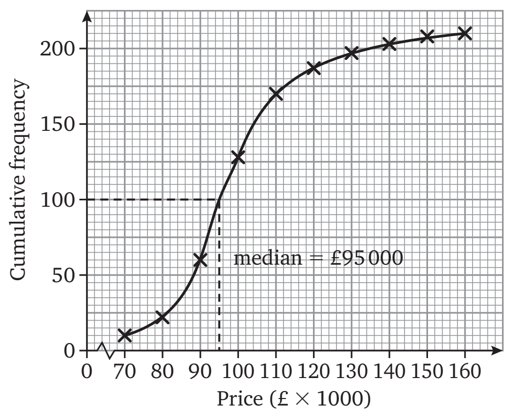


b 6

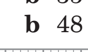
Exercise 8f (p 170)

1 question 1, 1.5
question 2, 48
question 3, 44

2



median £95 000

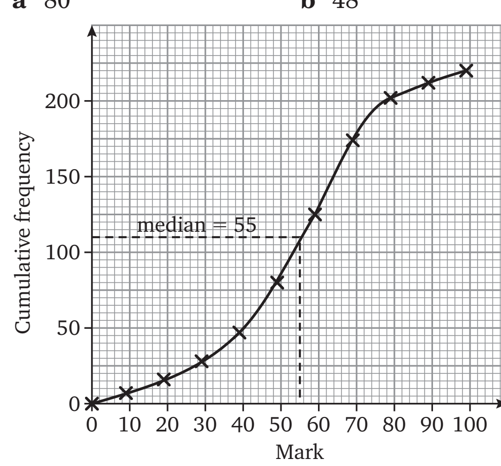



3 **a** 48 **b** 35

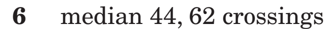
4 **a** 80 **b** 48



5

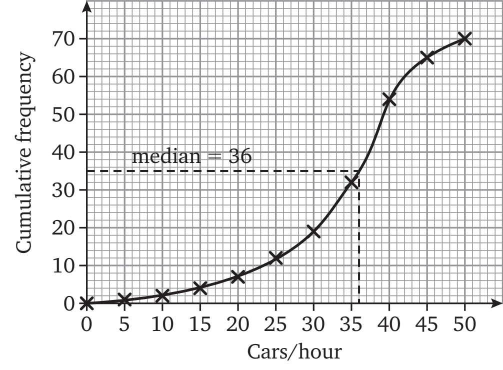


median 55



6 median 44, 62 crossings

7



median 36 cars/hour

Exercise 8g (p 174)

1 question 1, Q_3 3.3, Q_1 0.4, iqr 2.9
question 2, Q_3 60, Q_1 35, iqr 25
question 3, Q_3 56, Q_1 34, iqr 22

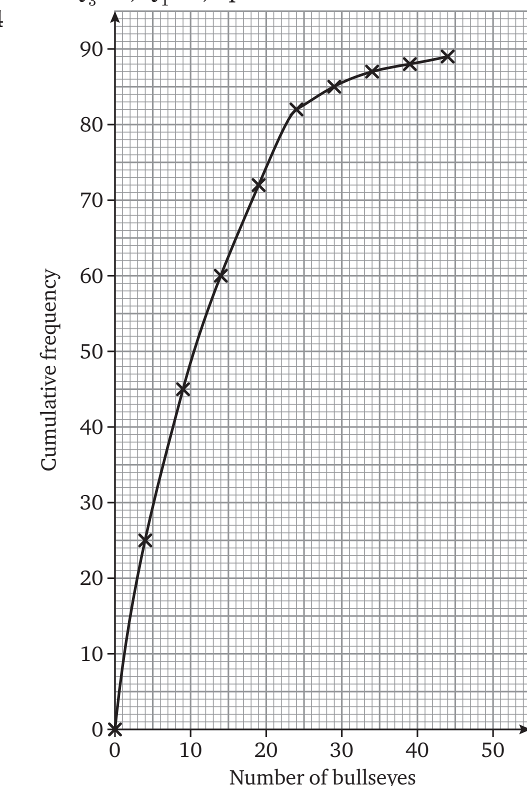
2 **a** £22
b Q_3 £33.5, Q_1 £16
c £17.5

3

Cumulative frequency: 0, 100, 200, 300, 400
Age: 0 10 20 30 40 50 60 70 80 90 100

a 328
b 63
c Q_3 74, Q_1 49, iqr 25

4



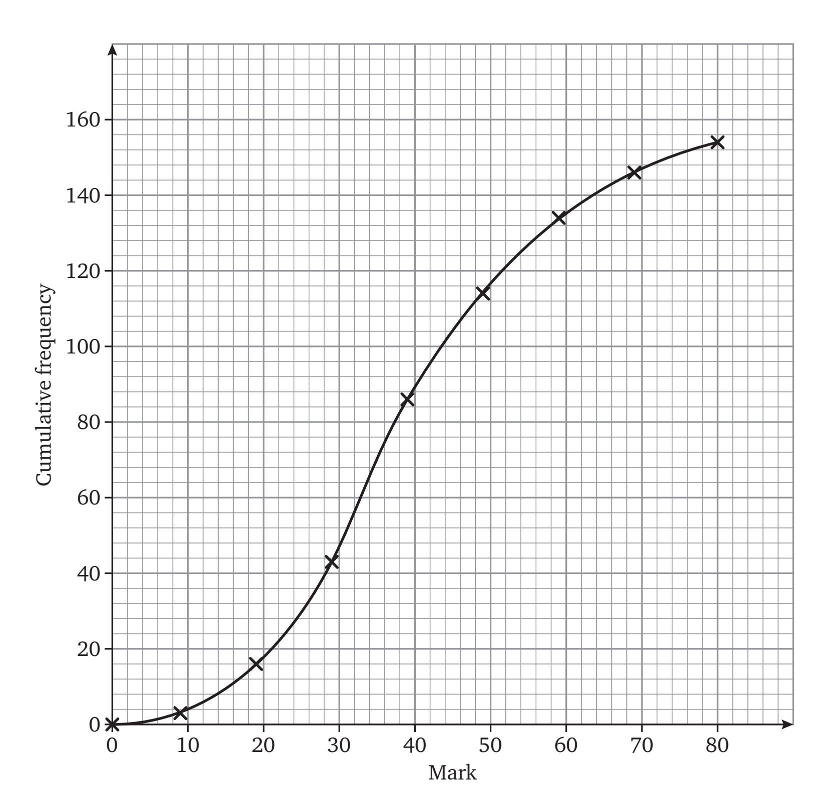
a 9 **b** Q_3 17, Q_1 3.5

5 **a**

Score	67	68	69	70	71	72	73	74
Cumulative frequency	4	11	20	29	35	38	39	40

b 20
c 20
d 69
e can be found directly from the table as the scores are not grouped

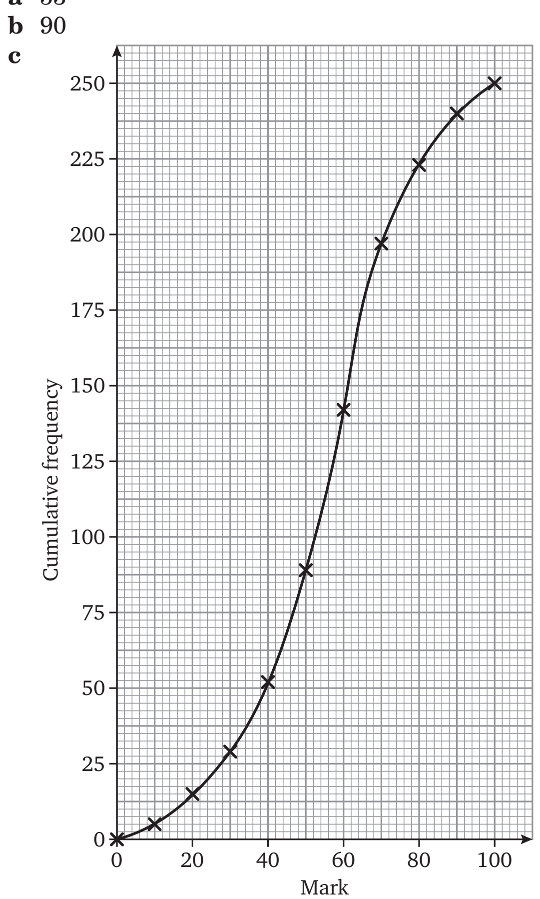
6



a 36
b Q_3 49, Q_1 25, iqr 24
c 28

Exercise 8h (p 177)

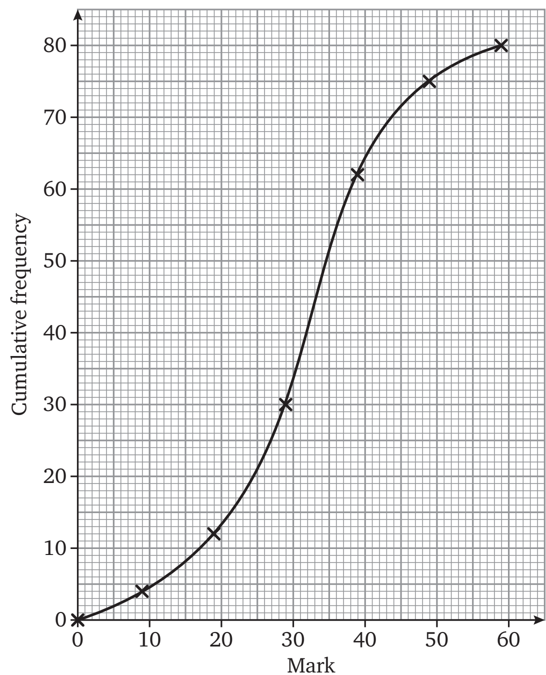
1 **a** 53
b 90
c



d **i** 57.5
ii Q_3 68, Q_1 43
e **i** $\frac{89}{250}$
ii $\frac{54}{125}$

2 **a** 20
b £2.60
c 60 students receive £1.50 or less
d £4.20 The iqr gives the range of pocket money received by the middle half of the students ranked in order of the amount of pocket money they receive.
e £735
f £3.06

3



a 32
b Q_3 38, Q_1 24
c 16
d 27
e $\frac{3}{8}$
f

Mark	1 | 2 means 12
0	8 8 8 9
1	2 3 3 5 6 8 8 9
2	0 1 1 3 3 3 4 4 4 5 6 7 7 7 7 8 9 9
3	0 1 1 1 2 2 2 2 2 3 3 3 3 4 4 4 5 5 6 6 6 7 7 7 7 8 8 8 8 9 9 9
4	0 1 3 3 4 5 6 7 7 7 7 8 8 9
5	2 2 4 7 8

4 **a** Herd A: median 13, range 20, iqr 5
Herd B: median 11, range 20, iqr 5.5
b The median yield of Herd A is higher. The ranges are the same but the interquartile range of Herd A is lower. The yield per cow in Herd A is less variable and generally slightly higher than for Herd B.

5 **a** **i** 99
ii 102
b **i** $\frac{5}{102}$
ii 0
d Girls: median £2.40, iqr £3.30
Boys: median £3.80, iqr £3.80
e Both the range and the interquartile range of the boys' spending money is higher than the girls'. On average the boys have over £1 more spending money than the girls.

Chapter 9 Formulas

Exercise 9a (p 181)

1 $a = b + c$
2 $m = 2(n + p)$
3 $z = xy$
4 $a = 2bc$
5 $d = e - f$
6 $n = p + p^2$
7 $v = u + at$
8 $R = Np$
9 $N = y + z$
10 $X = xy$
11 $Q = P - \frac{nx}{100}$
12 $b = \frac{ac}{1000}$
13 $R = \frac{x}{10} + \frac{y}{5}$

Exercise 9b (p 182)

1 2
2 $\frac{3}{4}$
3 30
4 24
5 **a** 6 **b** 14.96 **c** 1.4141
6 **a** 10 **b** 8.61
7 4
8 **a** 9 **b** 141.61
9 $2\frac{2}{3}$
10 2
11 32
12 21
13 6
14 1605.5 cm^3 (to 3 s.f.)
15 103 mm Hg (to the nearest whole number)
16 **a** 9.71% (to 3 s.f.) **b** 4.26% (to 3 s.f.)

Exercise 9c (p 184)

1 **a** 6 **b** 4
2 **a** 13 **b** 3
3 **a** 4 **b** 3
4 **a** 17 **b** 8
5 **a** 3.7 **b** 2.9
6 **a** $b = 6$
b $a = 100$
c any jump over 6 m
d **i** 25 **ii** 179.56

Exercise 9d (p 186)

1 $\frac{4}{5}$
2 1
3 $-1\frac{1}{3}$
4 $\frac{2}{3}$
5 $2\frac{1}{2}$
6 3
7 $-\frac{7}{8}$
8 $\frac{2}{9}$
9 $\frac{1}{3}$
10 $s = p - r$
11 $y = x - 3$
12 $b = a + c$
13 $v = u + 5$
14 $y = z - x$
15 $Y = X + Z$
16 $s = r - 2t$
17 $m = k - l$
18 $P = N + Q$
19 $u = v - 10t$
20 $y = \frac{x}{2}$
21 $t = 2v$
22 $b = \frac{a}{c}$
23 $u = 3t$
24 $m = kl$
25 $b = \frac{a}{3}$
26 $N = 10X$
27 $u = \frac{v}{t}$
28 $w = 100z$
29 $p = nq$

Exercise 9e (p 188)

1 $s = \frac{(p - r)}{2}$
2 $t = \frac{(u - v)}{3}$
3 $c = \frac{(b - a)}{4}$
4 $v = \frac{(V - 3u)}{2}$
5 $w = \frac{(x + y)}{2}$
6 $t = \frac{(l - k)}{4}$
7 $y = \frac{(x - w)}{6}$
8 $s = \frac{(It - N)}{2}$
9 $y = \frac{4x}{3}$
10 $t = \frac{(u - v)}{5}$
11 $I = 10(A - P)$
12 $y = 3(x - z)$
13 $R = \frac{(VI)}{2}$
14 $r = \frac{(p + w)}{2}$
15 $c = 2(a - b)$
16 $r = 5(q - p)$
17 $u = v - at$, $u = 140$
18 $B = A - \frac{C}{100}$, $B = 17.5$

19 $C = PN, C = 10$
20 $X = 2(z + 3t), x = -10$
21 **a** $a = b + 2c$
b 4
c $b = a - 2c$
22 **a** $x = 2yz$
b 12
c $y = \frac{x}{2z}$
23 **a** $d = e^2 + 2f$
b $f = \frac{1}{2}(d - e^2)$
c $f = \frac{1}{2}$
24 **a** 400 °F
b $G = \frac{(F - 250)}{25}$
c 8
25 **a** 159 cm
b $f = \frac{(h - 40)}{3.5}$
c 33.7 cm (to 3 s.f.)
d 2.86 cm (to 3 s.f.). The formula is only valid for adult women.
26 **a** $H = \sqrt{\frac{W}{I}}$
b 2.01 m

Exercise 9f (p 190)

1 $v^2 = u^2 + 4us$
2 $p = \frac{v}{2}$
3 $p = r - 4t^2$
4 $A = 2ac + \frac{5a^2}{2}$
5 $A = \frac{3b}{4}(b - a)$
6 $s = 2us + 20s^2$
7 $P = 4V^2$
8 $n = \frac{(p + q)}{(p - q)}$
9 $P = \frac{1}{3}(2 - S)$
10 $a = \frac{10c^2}{4} = \frac{5c^2}{2}$

Exercise 9g (p 192)

1 3, 5, 7, 9, ... 15
2 1, 3, 5, 7, ... 13
3 2, 4, 8, 16, ... 128
4 1, 4, 9, 16, ... 49
5 0, 3, 8, 15, ... 48
6 5, 6, 7, 8, ... 11
7 5, 7, 9, 11, ... 17
8 $1, \frac{1}{2}, \frac{1}{3}, \frac{1}{4}, \ldots \frac{1}{7}$

Exercise 9h (p 193)

1 $3n$
2 $-n$
3 $n + 1$
4 $n - 1$
5 $4n$
6 $5n$
7 $5 + 2n$
8 $3(n - 1)$
9 $4 - n$
10 $\frac{1}{2}(7 - n)$

Exercise 9i (p 194)

1 $3 \times 2^{n-1}$
2 $5 \times 3^{n-1}$
3 $2.8 + 0.2n$
4 $\frac{10}{2^{n-1}}$
5 $0.5(n - 1)$
6 $-(-2)^n$
7 $n + 4$
8 $\frac{(-1)^{n-1}}{2^{n-2}}$
9 $\frac{1}{n+2}$
10 $n(n+2)$
11 n^3
12 $n \times 2^n$
13 $n^2 + 5$
14 $2n^2 + 1$
15 $12 - n^2$
16 $n^3 + 2$
17 **a** 2^n **c** $(2n + 1)$th
18 **a** 2 m
b 20 m
c $(n^2 + n)$ m

Exercise 9j (p 195)

1 $z = 3x - y$
2 **a** 5.24 **b** 9.7
3 **a** $d = \frac{C}{\pi}$
b $d = a - c$
4 **a** $b = \frac{(a - c)}{7}$
b $b = 2(c - a)$
5 **a** 4, 10, 18, 28, ... 180
b $n^2 + n$
6 **a** 48
b 4
7 $v = 21u$

Exercise 9k (p 196)

1 $P = 4x - 10$
2 **a** 37.5 **b** 550
3 **a** 56 **b** −21.1
4 **a** $Q = 10P$
b $Q = \frac{(P - R)}{3}$
5 **a** 2, 7, 12, 17, ... 97
b $3(-2)^{n-1}$
6 −1.5
7 $A = 4 - h^2$

Chapter 10 Simultaneous equations

Exercise 10a (p 198)

1 $x = 3, y = 1$
2 $x = 1, y = 2$
3 $x = \frac{1}{3}, y = 1$
4 $x = -12, y = 27$
5 $x = 0, y = 1$
6 $x = 4, y = 3$
7 $x = 1, y = 2$
8 $x = 2, y = 1$
9 $x = 3, y = -1$
10 $x = 0, y = 3$
11 $x = 1, y = -1$
12 $p = 3, q = \frac{1}{2}$

Exercise 10b (p 200)

1 $x = 3, y = 2$
2 $x = 1, y = 5$
3 $x = 3, y = 1$
4 $x = 1.5, y = 0$
5 $x = 0, y = 6$
6 $x = 3, y = -1$
7 $x = 1, y = 4$
8 $x = 1, y = 1$
9 $x = 2, y = 2$
10 $x = 3, y = -1$
11 $x = 4, y = 2$
12 $x = -3, y = 0$
13 $x = 2, y = \frac{2}{3}$
14 $p = -1, q = 2$
15 $x = 3, y = -2$
16 $x = 2, y = -2$
17 $x = 0, y = 4$
18 $x = -1, y = -2$
19 $x = 1, y = 1$
20 $x = 3, y = 1$
21 $x = 2, y = -1$
22 $x = 8, y = 4$
23 $x = -3, y = 4$
24 $x = 3, y = -3\frac{1}{2}$
25 $x = 3, y = 4$
26 $x = 2, y = 5$
27 $x = 3, y = 2$
28 $x = -1, y = -3$

Exercise 10c (p 201)

1 $x = 1, y = 4$
2 $x = -1, y = 5$
3 $x = 3, y = -2$
4 $x = -1, y = -1$
5 $x = 3.5, y = 2.5$
6 $x = 1, y = -2$
7 $x = 6, y = 28$
8 $x = 2, y = 3$
9 $x = 3, y = 1$
10 $x = 5, y = 0$
11 $x = 0, y = 4$
12 $x = -4, y = -5$
13 $x = 2, y = 4$
14 $x = 5, y = 3$
15 $x = 1, y = 1$
16 $x = -2, y = 7$
17 $x = 4, y = 6$
18 $x = 1, y = 1$
19 $x = 1, y = 10$
20 $x = 2\frac{1}{3}, y = -\frac{2}{3}$
21 $x = -1, y = 5$
22 $x = -12, y = -4$
23 $x = 2, y = 6$
24 $x = 4\frac{1}{2}, y = 7\frac{1}{2}$

Exercise 10e (p 203)

1 $x + y = 15; x + 3 = y; x = 6$
2 $4x + y = 540; 2y = x$; 120°
3 70 mm
4 **a** $3x + y = 33; x + 3y = 19$
b $x = 10, y = 3$
5 10, 6
6 11, 5
7 **a** $4a + 6b = 200; a + b = 48$
b 44
8 45
9 8
10 **a** $C = 8n$
b $C = 50 + 2n$
c $n = 8\frac{1}{3}$, so need to book the court for 9 hours to make it worth paying the membership fee.
11 $y = 2x + 1$
12 8 m
13 No; if the glasses are the same price, it costs £2.10

Exercise 10f (p 206)

1 $x = 2.4, y = 1.2$
2 $x = 2.4, y = 0.9$
3 $x = -0.4, y = 1.6$

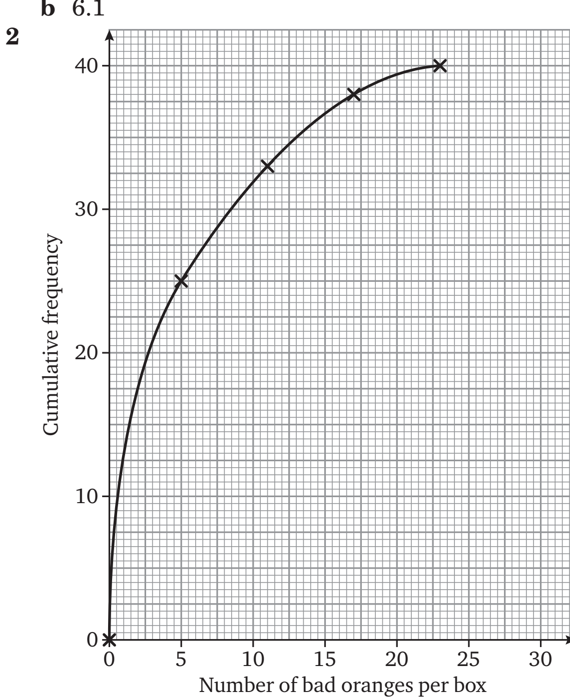
Summary 2

Revision exercise 2.1 (p 210)

1 **a** $3 - 3x$
b $a^2 + 3ab + 2b^2$
c $x^2 - 9x + 18$
2 **a** $x^2 + 4x - 21$
b $3x^2 - 7x - 20$
c $15x^2 - 7x - 2$
3 **a** $x^2 + 10x + 25$
b $4x^2 - 9y^2$
c $2x^2 + 6x + 2$
4 **a** $4(a + 3)$
b $x(x - 5)$
c $b^2(b - 3)$
5 **a** $(x + 9)(x + 2)$
b $(x - 2)(x - 4)$
c $(x - 5)^2$
6 **a** $(x - 5)(x + 3)$
b $(x + 4)(x - 2)$
c $(3 + x)(6 + x)$
d $(7 - x)(2 + x)$
7 **a** $(a + b)(a - b)$
b $(p + 2q)(p - 2q)$
c $(4x + y)(4x - y)$
8 **a** 3400
b 46.2

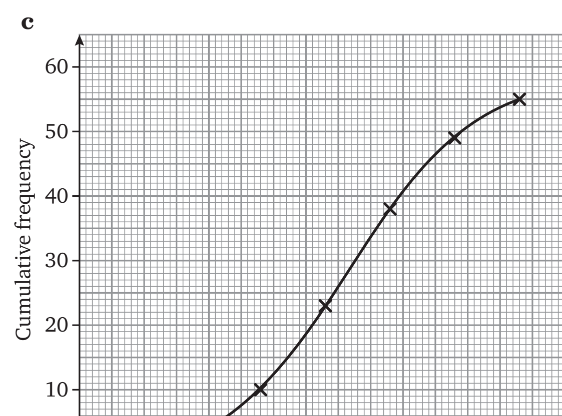
Revision exercise 2.2 (p 211)

1 **a** 0–5
b 6.1
2



median 3 (from graph), 4.8 calculated; Q_3 8.5, Q_1 0.5, iqr 8

3 **a** 55
b 17
c



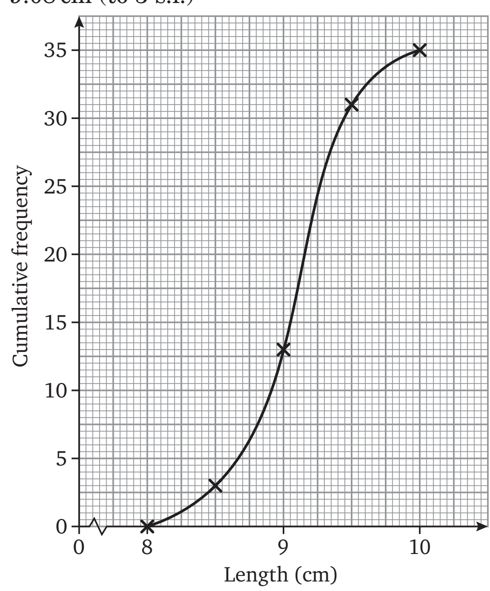
i median 75.5 kg
ii Q_3 80 kg, Q_1 70.5 kg
4 **a** $x = 3(p + q)$
b $z = 2xy$
c $z = x + y - xy$
5 **a** 7
b 5
c 7
6 **a** $-3, -1, 1, 3, \ldots 15$
b $4n$
7 **a** $x = 3$
b $R = 15t^2$
8 **a** $x = 4, y = -3$
b $x = 5, y = -1$
9 **a** $x = 2, y = -1$
b $x = 2, y = 3$
10 **a** $3x + 2y = 24, x + 2y = 23, x = 0.5, y = 11.25$
b $x = 2.6, y = 1.6$

Revision exercise 2.3 (p 212)

1 **a** $10 - 15a$
b $3x - 6xz + 2y - 4yz$
c $p^2 - 11p + 24$
d $12 + 5x - 3x^2$
2 **a** $9x^2 - 6x + 1$
b $x^2 + 9x + 10$
3 **a** $5(3 - x)$
b $(x - 5)(x + 3)$
c $(x - 7)(x - 3)$
d $2(x^2 + 2x + 4)$
4 **a** $(4 - x)(3 - x)$
b $(4 - x)(3 + x)$
c $(3 - a)(3 + a)$
d $(5 - x)(5 + x)$

5 **a** 9.08 cm (to 3 s.f.)

b



c **i** median 9.1 **ii** Q_3 9.3, Q_1 8.85, iqr 0.45

6 $C = nx$

7 **a** 16

b 90.25

8 $V = 24x^3$

9 **a** $x = 3, y = 2$

b $x = 2, y = -1$

Revision exercise 2.4 (p 213)

1 **a** 126 km

b 1 h 48 min

c $6\frac{2}{3}$ mph

2 **a** 1.09 pm

b 64 miles from Wexley at 1.40 pm

c 38 mph

3 **a** (number line from 0.65, filled circle, to 0.75, open circle)

b 45

c $\frac{55}{192}$

4 **a** $\frac{1}{6}$

b $\frac{1}{36}$

c $\frac{1}{18}$

5 £220

6 **a** 48

b 6 : 7

c £7.56

7 **a** $10ab + 15ac$

b $a + 3b - a^2 - 3ab$

c $7x^2 + 10x + 3$

d $x^2 - 8xy + 16y^2$

8 **a** $x(x + 6)$

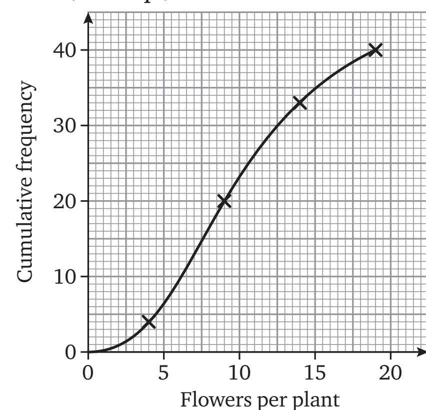
b $(x - 6)(x - 4)$

c $(4 - x)(2 - x)$

d $(p - 6)(p + 6)$

9 **a** 9.88 (to 2 d.p.)

b



median 9, Q_3 13, Q_1 6, iqr 7

10 **a** $T = \frac{(100I)}{PR}, T = 2$

b $s = \frac{(v^2 - u^2)}{2a}$

11 **a** $x = 4, y = -1$

b $x = 3, y = 9$

Revision exercise 2.5 (p 214)

1 **a** **i** 0.05 **ii** 8 **iii** $\frac{5}{9}$

b **i** $0.\dot{8}\dot{1}$ **ii** $0.91\dot{6}$ **iii** $0.\dot{2}3076\dot{9}$

c **i** $\frac{1}{20}$ **iii** $\frac{2}{25}$

ii $\frac{1}{200}$ **iv** $\frac{3}{50}$

d $\frac{100}{413}$

2 **a** $\frac{1}{6}$

b $\frac{25}{36}$

3 £150

4 **a** $1 : 2\frac{1}{3}$

b 2 cm

5 **a** $15xy - 6xz$

b $a^2 + 10a + 24$

c $5xz + 20x + 3yz + 12y$

d $a^2 + 6ab + 9b^2$

6 **a** 25 km

b 6 km

c 6 km/h

d 9 km

e 4 min

f 10 km/h

g 2.58 pm

h 2 h 5 min

i 12 km/h

j 1.50 p.m., 11 km from Antford

k 6 km

7 **a** $3t(1 - 2t)$

b $3(x + 4)(x - 1)$

c $(x - 6)(x + 2)$

d $(x + 4)^2$

8 **a** 48
b 18 min
c

Middle value, t (minutes)	1.5	4.5	7.5	10.5	13.5	16.5
Frequency	3	6	17	13	7	2

d 8.8 min (to 1 d.p.)

9 **a** $x = z + 2y$
b $r = \frac{(p - q)}{2}$
c $b = \frac{(a + c)}{3}$

10 24 mm, 74 mm, 74 mm

Mental arithmetic practice 2 (p 217)

1 $\frac{31}{40}$
2 2
3 75 g
4 36 cm
5 24
6 8 kg, 28 kg
7 0.6 : 1
8 1 : 1.8
9 90 cm
10 1 : 0.9
11 1.2
12 4
13 360°
14 1 : 12
15 (0, 2)
16 1.8 m
17 4 : 7
18 0.778
19 56 m
20 $\frac{1}{2}$
21 2813
22 6 days
23 £96
24 $A = \pi r^2$
25 18 cm
26 0.625
27 $x^2 - 9x + 20$
28 29
29 1200 mm^2
30 $x > -1$
31 $12xy + 8xz$
32 $x^2 + ax + bx + ab$
33 $x^2 + 2ax + a^2$
34 $x^2 - 2ax + a^2$
35 $x^2 - a^2$
36 275 cm
37 $a^2 + a - 6$
38 $a^2 - a - 6$
39 3 + 5 + 7
40 $V = \pi r^2 h$
41 5%
42 $10x$ cm
43 9
44 $b^2 - 11b + 28$
45 $b^2 + 11b + 28$
46 8
47 25 g/cm^3
48 $x^2 + 8x + 16$
49 1 : 2.5
50 trapezium
51 61
52 no
53 $x < -2$
54 135 miles
55 37
56 $x < 6$
57 60 m
58 $a^2 - 9b^2$
59 13 cm
60 38°

Chapter 11 Quadratic equations

Exercise 11a (p 220)

1 **a** 8 **b** 0 **c** 0
2 **a** 0 **b** 5 **c** 0
3 **a** 0 **b** 7 **c** 0
4 **a** 33 **b** 0 **c** 0
5 **a** -24 **b** 0 **c** 0
6 **a** 72 **b** 0 **c** 20
7 0
8 0
9 0
10 any value
11 4
12 1
13 **a** 0 **b** 0
14 **a** 0 **b** 0
15 $a = 0$ or $b = 1$
16 $a = 0$ or $b = 5$
17 $a = 0$ or $b = 2$
18 $a = 0$ or $b = 4$
19 $a = 3$ or $b = 0$
20 $a = 9$ or $b = 0$

Exercise 11b (p 222)

1 0, 3
2 0, 5
3 0, 3
4 0, -4
5 0, -5
6 0, 6
7 0, 10
8 0, 7
9 0, -7
10 0, -9
11 1, 2
12 5, 9
13 10, 7
14 4, 7
15 6, 1
16 8, -11
17 3, -5
18 -7, 2
19 -2, -3
20 -4, -9
21 -1, -8
22 p, q
23 $-a, -b$
24 4, -1
25 -9, 8
26 -6, -7
27 -10, -11
28 a, b
29 $-a, b$
30 $c, -d$
31 $\frac{3}{2}, -\frac{1}{2}$
32 $-\frac{7}{4}, \frac{1}{3}$

Exercise 11c (p 223)

1 2, 1
2 7, 1
3 2, 3
4 5, 2
5 4, 3
6 5, 1
7 11, 1
8 4, 2
9 6, 2
10 12, 1
11 -7, 1
12 4, -2
13 4, -3
14 5, -3
15 9, -2
16 13, -1
17 -3, 2
18 6, -2
19 -5, 4
20 8, -3
21 -2, -1
22 -7, -1
23 -5, -3
24 -6, -2
25 -9, -2
26 -6, -1
27 -5, -2
28 -13, -1
29 -15, -1
30 -6, -3
31 1, -1
32 3, -3
33 4, -4
34 9, -9
35 13, -13
36 2, -2
37 5, -5
38 10, -10
39 12, -12
40 6, -6

Exercise 11d (p 225)

1 0, 2
2 0, 10
3 0, -8
4 0, $\frac{1}{2}$
5 0, $\frac{5}{4}$
6 0, 5
7 0, -3
8 0, -1
9 0, $\frac{5}{3}$
10 0, $\frac{7}{5}$
11 0, $-\frac{3}{2}$
12 0, $-\frac{5}{8}$
13 0, 7
14 0, $-\frac{5}{3}$
15 0, $\frac{12}{7}$
16 0, $-\frac{7}{6}$
17 0, $-\frac{7}{12}$
18 0, -4
19 0, $\frac{2}{7}$
20 0, $-\frac{3}{14}$

Exercise 11e (p 226)

1 1
2 5
3 -4
4 -3
5 3
6 4
7 -1
8 -10
9 -9
10 11
11 $\frac{1}{2}$
12 -5
13 6
14 20
15 8
16 $-\frac{2}{3}$

Exercise 11f (p 226)

1 6, -5
2 8, -2
3 -12, 3
4 4, -2
5 6, -4
6 5, 7
7 3, -2
8 -7, 1
9 4, -3
10 5, -2
11 4, 2
12 10, -5
13 5, 2
14 7, 1
15 4, 2
16 -4, 7
17 6, 2
18 5, 4
19 7, 5
20 5, 3
21 0, 4
22 2, 1
23 -1, -2
24 6, 2
25 0, 2
26 0, 3
27 -1, -2
28 0, $\frac{1}{2}$
29 -4, 3
30 3, -1
31 8, -3
32 7, 5
33 5, -10
34 -11, 8
35 -9, 5
36 7, -2
37 7, -4
38 -11, 5
39 -5, -4
40 -5, -4

Exercise 11g (p 229)

1 5, −4
2 2
3 6, −6
4 −7, 1
5 −3
6 −2, 1
7 4, 1
8 5, −3
9 −8, −4
10 −10, 3
11 0, $-\frac{4}{3}$
12 0, $-\frac{5}{3}$
13 5, −3
14 $\frac{3}{2}$, −1
15 7, −5
16 −12, −1
17 2, −2
18 −5, 2
19 0, −9
20 −1, 9

Exercise 11h (p 230)

1 **a** x^2
b $6x + 16$
c $x^2 - 6x - 16 = 0$; 8, −2
2 **a** $x^2 - 5x$
b $x^2 - 5x - 14 = 0$; −2, 7
3 **a** $x^2 - 6$
b $x^2 + x - 6$
c $x^2 + x - 72 = 0$; −9 or 8
d 58
4 6
5 $x^2 + x = 56$; 7, 49
6 $y(y + 5) = 84$; $y = 7$ or -12; 7
7 $x + (x^2 + 2) = 44$; $x = -7$ or 6; 6, 38
8 **b** $x(x + 3)$
c $x^2 + 3x - 28 = 0$; $x = 4$ or -7; 4 cm by 7 cm
9 **b** $\frac{1}{2}x(x - 5)$
c $x^2 - 5x - 50 = 0$; $x = 10$ or -5
d 5 cm
10 $x(x + 5) = 66$; $x = -11$ or 6; 6 cm by 11 cm
11 10 seconds
12 **a** A : $20x$, B : x^2, C : $30x$
b $x^2 + 50x - 104 = 0$; 2 m
13 50 tonnes
14 **a** $x^2 + (x + 1)^2$ **b** 9

Exercise 11i (p 233)

1 1.4
2 2.1
3 2.8
4 1.4
5 0.7 or 11.3
6 1.3
7 3.1
8 6.9

Chapter 12 Graphs

Exercise 12a (p 237)

1 **a** \$35 **b** \$0.25 (25 c) **c** \$0.10 (10 c) **d** \$55
2 **a** 1.2 m
b **i** 1.5 m **ii** 2.5 m
c 2.875 m
3 **a** 40 km/h **b** 40 km **c** 48 km/h
4 **a** £500
b **i** £1250 **ii** £1500 **iii** £2050
c **i** £5 **ii** £2.75 **iii** \$2.25
d **i** 800 **ii** 280 **iii** 80

Exercise 12b (p 240)

1 **a** 3.8, −0.8 **b** 4.7, −1.7 **c** 4.55, −1.55 **d** 0.4, 2.6
2 **a** 4.8, −0.8
b 3.7, 0.3
c 4.2, −0.2
d 0.6, 3.4
e 1.0, 3.0
f 4.1, −0.1
g 2.0, one answer only
h no, need to plot to $y = -10$
3 **a** 2, −1
b not possible
c 1.6, −0.6
4 2.8, 0.7
5 **a** $y = x^2 + 2x - 4$ **b** $y = 3 - 5x - x^2$
6 **a** 0.9, −3.9
b 0.3, −3.3; $1 - 3x - x^2 = 0$

Exercise 12c (p 244)

1 **a** 2.7 **b** −2.5
2 **b** $x = 2$ (the line crosses the curve at only one point)
3 **a** **i** −3 **ii** 3
b 0.3, 1.5 **c** yes
4 $x = -3$
5 **a** 1.7, only one solution
b one; the line $y = -1$ cuts the curve once only; 2.0
c **i** $c < 0.85$, $c > 1$
ii $0.85 < c < 1$
6 When $y = 0$, $(x - 2)$ or $(x - 3)$ or $(x - 4)$ is zero, i.e. $x = 2, 3$ or 4.

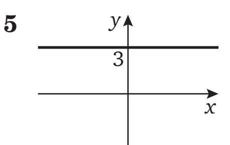
Exercise 12d (p 247)

1 cannot divide by zero
2 **a** 0.4
b 0.4
c 5
d gets larger very fast
e cannot divide by zero
f rotation order 2, 2 lines of symmetry
3 **a** cannot divide by zero
b **i** 0.8 **ii** −1.1
4 **a** $y = 1$ at $x = 12$
b 0.12
c approaching zero
d no
5 **a** $y < 0.1$ and getting smaller
b no; if $y = \frac{1}{x}$, then $xy = 1$ and $x \times 0 \neq 1$
c no; $0 \times y \neq 1$

Exercise 12e (p 249)

1 D **2** B **3** A **4** C

5



6

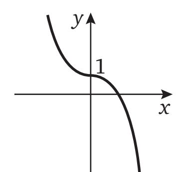
7

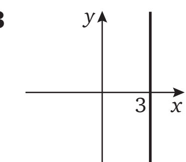
8

9

10

11

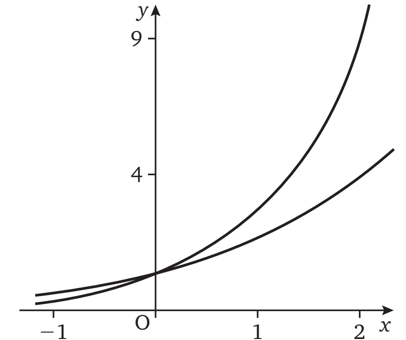
12 

13 

14 C
15 B
16 B
17 D
18 A
19 C
20 B
21 no scales given, so it is not possible to check other points

Exercise 12f (p 253)

1 **a** **i** 2.5 **ii** 0.8
b $k = 3$
2 **a** **i** 13° **ii** 4°
b 3.7 min
c There is a value for temperature when time is zero, so not in the form $y = \frac{1}{x}$
3 **a** 13 m
b 15.5 m
c 1 s and 4 s
d 5 s
4 **b** $5a + b = 0$
c $a + b = 10$
d −2.5 and 12.5; $h = -2.5t^2 + 12.5t$
5 **a** missing values are 16, 32, 2^1, 2^3, 2^4, 2^5
b $n = 2^t$
6 **a** £1250
b 1250, 265, 312,50
c $y = 10\,000 \times \left(\frac{1}{2}\right)^n$
d $y = 10\,000 \times \left(\frac{1}{2}\right)^0$
e there is on value of n for which $\left(\frac{1}{2}\right)^n$ is zero
7 **a** (0, 1)
b there is no value of x for which 3^x is zero
c



d (0, 1)
e because $a^0 = 1$ for all values of a except 0

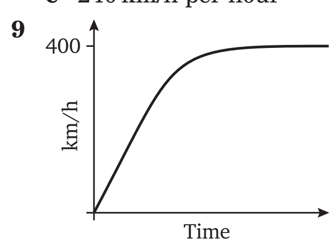
8 **a** 6.4×10^6 metres
b 3.75
c 12.6×10^6, 6.2×10^6 metres
9 $a = \frac{1}{8}$, $b = 1$

Exercise 12g (p 258)

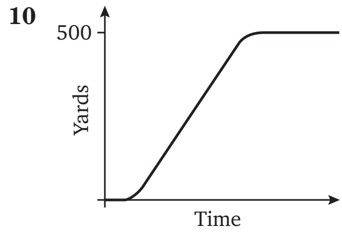
1 +ve increasing
2 +ve decreasing
3 large +ve, decreasing to C, then increasing
4 −ve increasing
5 +ve increasing to C, then constant
6 large +ve decreasing to zero, then −ve increasing

Exercise 12h (p 259)

1 **a** The temperature falls, rapidly at first then more slowly.
b hardly changing at all
c room temperature
2 **a** increase, no
b B–C constant, C–D increasing more rapidly
3 **a** **i** A–B; **ii** B–C
b maximum
c red, because the car stops
d at point D
e at point E
4 **a** the balloon bursts
b A–B increasing; B–C constant
c stopping to take breath
5 **a** large and positive at A, decreases to zero at B and continues to decrease until large and negative at C
b **i** at points A and C
ii at point B
6 Climbs slowly then more rapidly, then the rate of increase slows until cruising height is reached and this height remains steady.
7 **a** The oven is at room temperature.
b temperature increasing
c thermostat cutting in and out, keeping temperature within a narrow range
8 **a** **i** A–B and D–E
ii B–C
iii E–F
b 7.5 min
c 240 km/h per hour
9

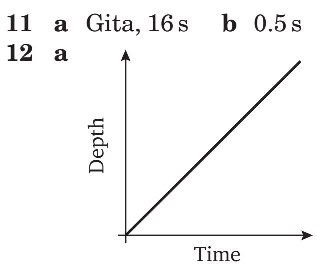


10

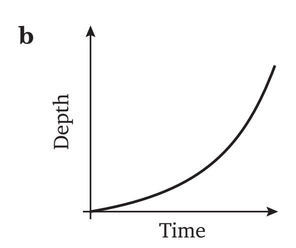


11 **a** Gita, 16 s **b** 0.5 s **c** Phoebe **d** 40 m

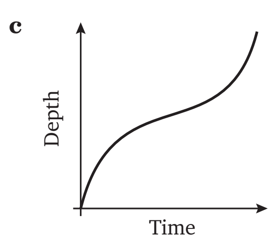
12 **a**



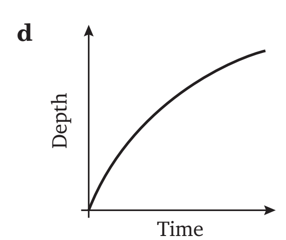
b



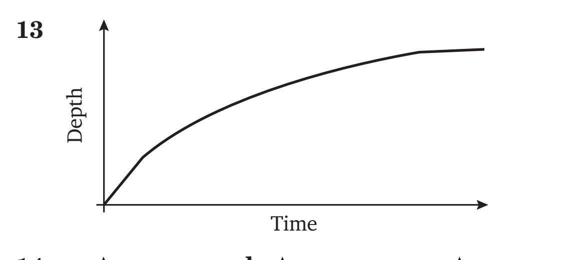
c



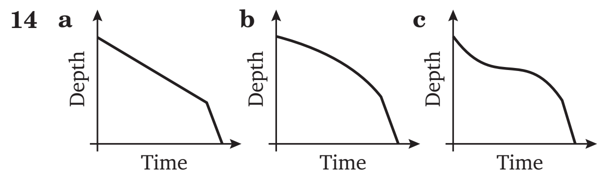
d



13



14 **a** **b** **c**



Chapter 13 Areas and volumes

Unless otherwise indicated, answers that are not exact are given to three significant figures.

Exercise 13a (p 265)

1 42 cm^2
2 21 cm^2
3 94.5 cm^2
4 8.75 cm^2
5 30 sq units
6 33 sq units
7 56 sq units
8 **a** 5.85 m^2 **b** 1.6 m^2 **c** 2.16 m^2 **d** 2.09 m^2
9 **a** 316 mm^2 **b** 18 600 mm^2
10 **a** 72 cm^2 **b** 5.76 m^2
11 20 560 mm^2
12 35.9 g

Exercise 13b (p 268)

1 **a** 22.5 sq feet **b** 216 sq inches
2 6.7 acres
3 6.5 acres
4 **a** 0.6 hectares **b** 1.6 acres
5 **a** 60 296 960 acres
b 24 400 000 hectares
c 244 000 km^2
6 10 981 km^2; no, because the conversion is given only correct to 5 s.f. so the answer may not be correct to 5 s.f.

Exercise 13c (p 270)

1 **a** 10.5 cm **b** 52.4 cm^2
2 **a** 10.5 cm **b** 26.2 cm^2
3 **a** 1.88 cm **b** 2.26 cm^2
4 **a** 4.19 cm **b** 6.70 cm^2
5 **a** 188 m **b** 6790 m^2
6 **a** 3.14 m **b** 18.8 m^2
7 **a** 2.98 m **b** 2.84 m^2
8 **a** 19.4 m **b** 9
9 58.6 mm^2
10 blue (102 cm^2 rather than 92 cm^2)
11 **a** 94.6 mm **b** 456 mm^2
12 **a** 48 hectares **b** 120 acres

Exercise 13d (p 273)

1 2175 cm^3
2 32 000 cm^3
3 1920 cm^3
4 17.6 m^3
5 55.4 m^3
6 0.66 cm^3
7 88 cm^3
8 2577 cm^3
9 0.72 m^3
10 1728 cm^3
11 9 cm
12 3.2 m^2
13 **a** 44 cm^2 **b** 9 cm
14 **a** 60 cm^2 **b** 20 cm
15 28.9 cm

Exercise 13e (p 276)

1 **a** 0.05 cm **b** 0.5 mm
2 14.4 in
3 0.144 litres
4 **a** 0.047 litres **b** 2.83 litres
5 **a** 13, 13, 10 **b** 60 cm^2 **c** 1200 cm^3 **d** 840 cm^2
6 0.1 mm
7 **a** 2250 m^3
b 30 000 cm^3 (30 litres)
c 5.2 h
8 9.7 cm
9 14 mm
10 **a** 8.46 cm
b volumes are equal
c cuboid by 3 cm
11 34.36 kg
12 **a** $\frac{1}{2}(a + b)ch$
b $(a + b)h + c(a + h + b) + c[(b - a)^2 + h^2]^{\frac{1}{2}}$
13 10.8 in
14 89.1 g

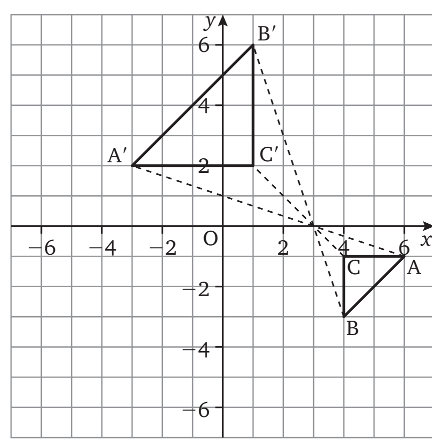
Exercise 13f (p 280)

1 **a** L **b** V **c** A **d** V **e** L **f** A
2 **a** L **b** V **c** V **d** L **e** A **f** A
3 **a** cm **b** cm^3 **c** cm^2 **d** cm **e** cm^2 **f** cm^3
4 **a** A **b** V **c** L **d** A **e** V **f** A **g** L **h** L **i** A
5 **c** and **e** are incorrect
6 $2\pi r$ represents a length
7 2
8 **a** $2r + \pi r$ **b** $\pi r^2 - \frac{1}{4}\pi r^2$
9 $V = \frac{1}{3}\pi r^2 h$ is the only one with correct dimensions
10 **a** $\pi^2 (R^2 - r^2)$ **b** $\frac{1}{4}\pi^2(R + r)(R - r)^2$
11 $A = 2\pi r(r + h)$ is the only one with correct dimensions
12 **a** $\pi a^2 b + 4a^2 c$ **b** $2\pi ab + 8ac + 8a^2$

Chapter 14 Transformations

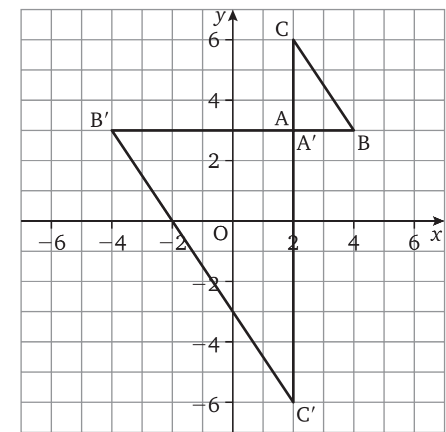
Exercise 14a (p 286)

1 (5, 6), scale factor −2
2 (0, 1), scale factor −3
3 (0, 1), scale factor −2
4 (1, 5), scale factor −2
5 (2, 2), scale factor −1
6 (−2, 2.3), scale factor −2
7



(3, 0), scale factor −2

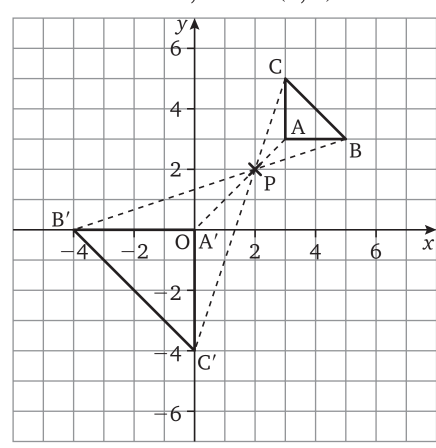
8



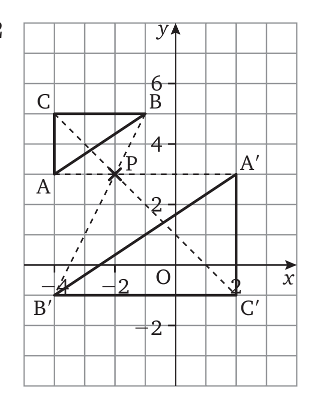
(2, 3), scale factor −3

9 a (0, 0), scale factor −1
b rotation 180°, centre (0, 0)

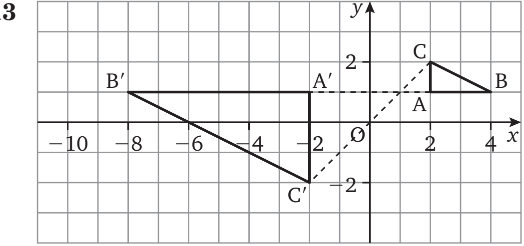
11



12



13



Exercise 14b (p 289)

1 mirror line $y = 0$
2 mirror line $y = 1$
3 mirror line $x = 2$
4 mirror line $y = x$
5 mirror line $x = -\frac{1}{2}$
6 mirror line $y = 1$, (2, 1) invariant
7 mirror line $y = x - 1$
8 no, they are of different lengths
10 mirror line $y = 1 - x$
11 mirror line $y = 9 - 4x$
12 mirror line $y = 9 - 4x$

Exercise 14c (p 292)

1 (0, 0), 90° clockwise
2 (1, 1), 90° anticlockwise
3 (− 1 , 2), 180°
4 (1, 1), 90° clockwise
5 (1, 1), 180°
6 (− 1 , 0), 180°

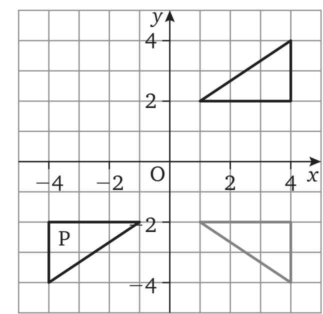
Exercise 14d (p 294)

1 82° anticlockwise
2 100° clockwise

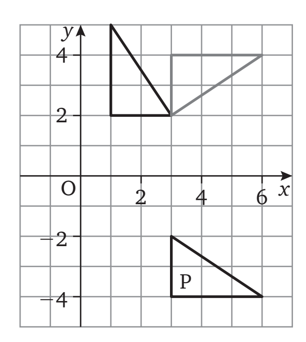
Exercise 14e (p 294)



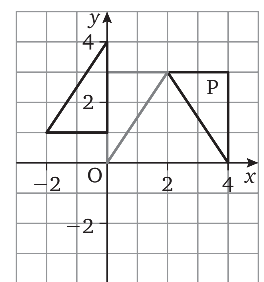
1



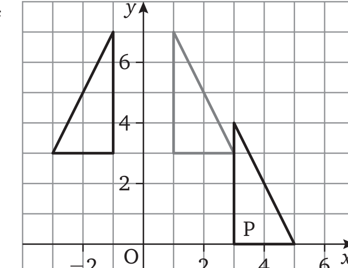
2



3



4



(In questions **5** to **8**, the transformations given are not the only possibilities.)

5 Reflect in both axes.

6 Rotate 90° clockwise about $(-4, 3)$, then reflect in the y-axis
or reflect in $y = 2 - x$, then translate 5 units right and 3 units down.

7 Reflect in the line $y = 2$, then translate 6 units right.

8 Reflect in the x-axis, then translate 6 units right.

Exercise 14f (p 296)

1 scalar
2 vector
3 scalar
4 scalar
5 scalar
6 vector
7 vector

Exercise 14g (p 298)

1 $\begin{pmatrix}3\\2\end{pmatrix}$

2 $\begin{pmatrix}4\\1\end{pmatrix}$

3 $\begin{pmatrix}-2\\2\end{pmatrix}$

4 $\begin{pmatrix}3\\0\end{pmatrix}$

5 $\begin{pmatrix}-3\\4\end{pmatrix}$

6 $\begin{pmatrix}-5\\-3\end{pmatrix}$

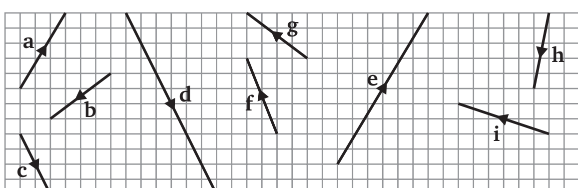
7 $\mathbf{g} = \begin{pmatrix}5\\0\end{pmatrix}$ $\mathbf{k} = \begin{pmatrix}-6\\-2\end{pmatrix}$

$\mathbf{h} = \begin{pmatrix}-4\\0\end{pmatrix}$ $\mathbf{l} = \begin{pmatrix}3\\-1\end{pmatrix}$

$\mathbf{i} = \begin{pmatrix}6\\2\end{pmatrix}$ $\mathbf{m} = \begin{pmatrix}0\\-4\end{pmatrix}$

$\mathbf{j} = \begin{pmatrix}-6\\7\end{pmatrix}$ $\mathbf{n} = \begin{pmatrix}4\\2\end{pmatrix}$

8–16



17 $\mathbf{e} = 2\mathbf{a}$, $\mathbf{d} = 3\mathbf{c}$
18 (7, 4)
19 (1, −2)
20 (−3, 7)
21 (1, −5)
22 (8, 1)
23 (8, 0)
24 (−1, 0)
25 (−9, −8)
26 (2, 0)
27 (7, −4)
28 (−9, −1)
29 (−7, −3)
30 (−6, −1)
31 (−2, −3)
32 (3, −2)
33 (−2, −3)
34 (1, −3)
35 (1, 5)
36 (−7, 4)
37 (−1, −10)
38 (−6, −6)

Exercise 14h (p 301)

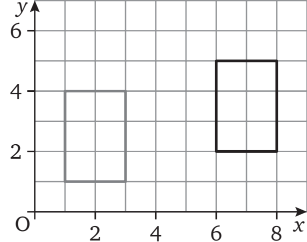
1 $\begin{pmatrix}5\\2\end{pmatrix}$

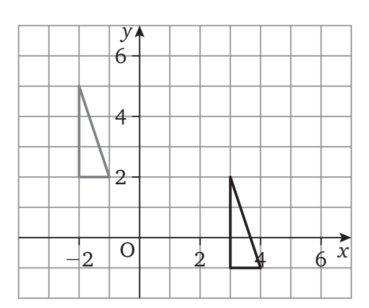
2 $\begin{pmatrix}5\\-3\end{pmatrix}$

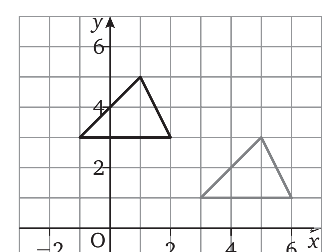
3 $\begin{pmatrix}-4\\-6\end{pmatrix}$

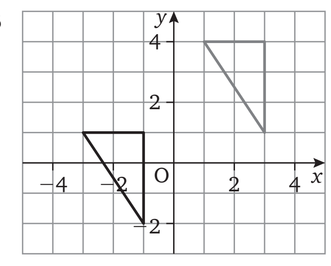
4 $\begin{pmatrix}-5\\3\end{pmatrix}$



5


6


7


8


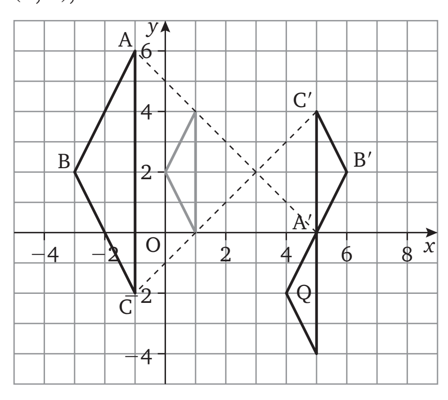
9 question 5 $\begin{pmatrix}-5\\-1\end{pmatrix}$, question 6 $\begin{pmatrix}-5\\3\end{pmatrix}$,

question 7 $\begin{pmatrix}4\\-2\end{pmatrix}$, question 8 $\begin{pmatrix}4\\3\end{pmatrix}$

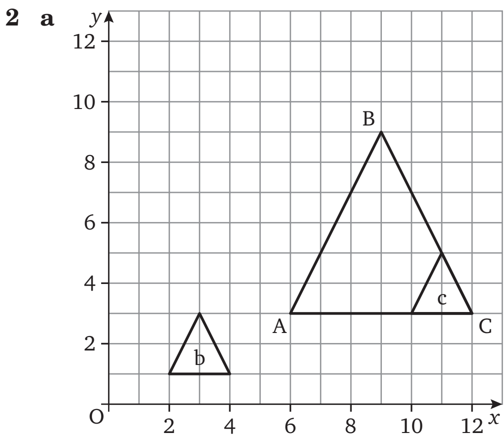
Exercise 14i (p 302)

1 **a** (3, 2), scale factor −0.5

b



2 **a**



c (11, 5)

d scale factor 3, centre (12, 3)

3 **a** points (2, 0) and (0, −2)

b 90° clockwise

c C_3 (10, 0)

d translation defined by the vector $\begin{pmatrix}1\\-3\end{pmatrix}$

e **i** $\begin{pmatrix}-1\\3\end{pmatrix}$ **ii** $\begin{pmatrix}-4\\4\end{pmatrix}$ **iii** $\begin{pmatrix}5\\-13\end{pmatrix}$

Chapter 15 Similar figures

Exercise 15a (p 308)

1 a yes
  b AC 2 cm, CB 1.6 cm, A′C′ 4 cm, C′B′ 3.2 cm
  c 2
  d all the same
2 a yes
  b AC 3.8 cm, CB 3.4 cm, A′C′ 2.6 cm, C′B′ 2.3 cm
  c 0.7
  d all the same
3 a yes
  b AC 32 mm, CB 26 mm, A′C′ 20 mm, C′B′ 17 mm
  c 0.6
  d all the same
4 a yes
  b AC 20 mm, CB 30 mm, A′C′ 30 mm, C′B′ 45 mm
  c 1.5
  d all the same
5 similar
6 similar
7 similar

Exercise 15b (p 310)

1 ABC similar to PQR; $\frac{AB}{PQ} = \frac{BC}{QR} = \frac{CA}{RP}$
2 ABC similar to PRQ; $\frac{AB}{PR} = \frac{BC}{RQ} = \frac{CA}{QP}$
3 not similar

Exercise 15c (p 311)

1 similar; 2.5 cm
2 similar; 7.2 cm
3 not similar
4 similar; 6.3 cm
5 similar; 4.8 in
6 7.5 cm
7 7.5 cm
8 8.3 cm
9 4.5 cm
10 b 4 cm
11 b CD = 9 cm, DE = 10.5 cm
12 b EF = 5 cm
13 b DE = 18 cm, AE = 13.5 cm, CE = 4.5 cm

Exercise 15d (p 316)

1 8 cm
2 6 cm
3 10 cm
4 24 cm
5 6 cm

Exercise 15e (p 317)

1 similar, $\widehat{P} = \widehat{A}$
2 similar, $\widehat{Q} = \widehat{A}$
3 not similar
4 similar, $\widehat{P} = \widehat{A}$
5 not similar

Exercise 15f (p 319)

1 $x = 4, y = 4$
2 $x = 5, y = 3.6, z = 7.5$
3 $x = 6.7$
4 $x = 2.6$
5 $x = 4.8, y = 9, w = 1.8$
6 2.56 km
7 900 m

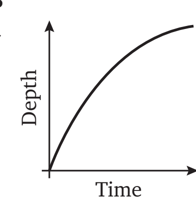
Exercise 15g (p 321)

1 A, C, E
2 a similar; $\frac{AB}{DF} = \frac{BC}{FE} = \frac{CA}{ED}$
  b not similar
3 similar; 6.75 cm
4 8 cm
5 similar
6 $x = 2, y = 10, z = 4$

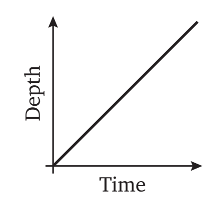
Summary 3

Revision exercise 3.1 (p 326)

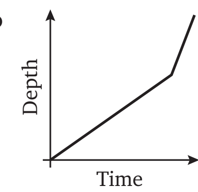
1 **a** 4, −3 **b** 0, 5
2 **a** 7, −2 **b** 0, 3 **c** 6
3 **a** **i** 3, 5 **ii** 0, $\frac{1}{3}$ **iii** −2, 10 **iv** 2, −2
b $x(x + 5) = 24$; 8 cm × 3 cm
4 **a** 2 **b** −5 **c** −6 **d** 0.5
5 B
6 **a**



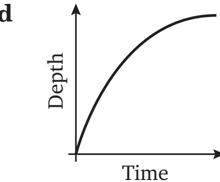
c



b



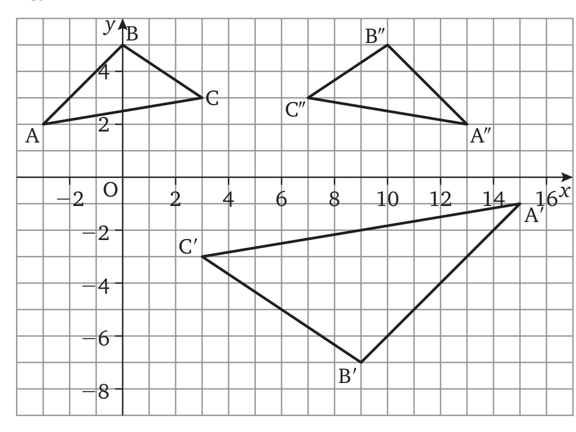
d



7 **a** 19.6 cm² **b** 354 cm²
8 **a** 31.4 cm (to 3.s.f) **b** 188.5 cm² (to 4 s.f.)
9 **a** **i** 26 cm² **ii** 9 cm
b 5.53 cm (to 3 s.f.)
10 **a** **i** V **ii** L **iii** A **iv** A
b 258 cm³

Revision exercise 3.2 (p 329)

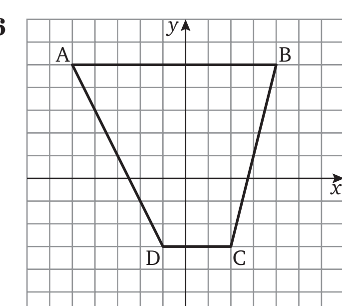
1 **a**



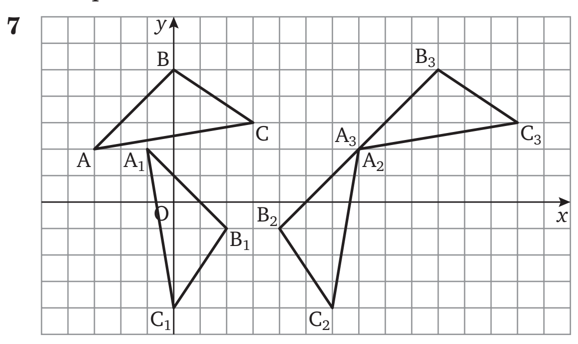
centre of enlargement (3, 1); scale factor −2
b A″ (13, 2), B″ (10, 5), C″ (7, 3)
2 gradient 1; y-intercept 3
3 (4, 8), 90° clockwise
4 C_3 (6, 1)
5 **a** **i** $\begin{pmatrix} -1 \\ 7 \end{pmatrix}$ **ii** $\begin{pmatrix} 1 \\ -7 \end{pmatrix}$
b 1 unit right and 7 units down
6 **a** yes **b** $\frac{DF}{AB} = 0.75$
7 BC = 8 cm
8 **b** CD = 6.7 cm, DE = 8 cm
9 similar; angle P = angle A
10 $x = 9$ cm, $y = 2$ cm, $z = 5$ cm

Revision exercise 3.3 (p 331)

1 **a** 0, −7 **b** 7, −7 **c** 4, −7
2 **a** 1 **b** 3, 6 **c** −1, −3
3 **a** cubic **b** three; −2, 1, 5
4 C
5 **a** **i** 14.4 cm²
ii 129.6 cm³
b 5.06 cm
6



48 square units
7

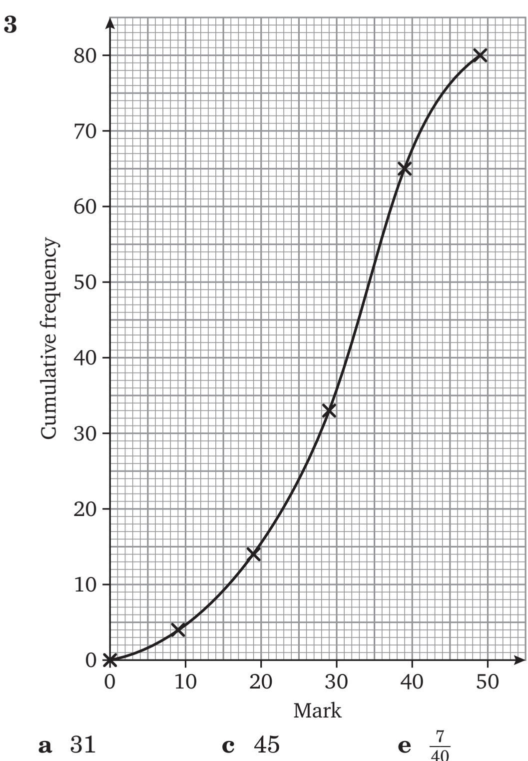


d reflection in $x + y = 9$
8 **a** no; ratios of corresponding sides are not equal
b **i** F **ii** T **iii** F **iv** T
9 **b** DE = 12.5 cm

Revision exercise 3.4 (p 333)

1 **a** **i** 0.005 **iii** 0.32 **v** 0.054
ii 5.625 **iv** 0.78 **vi** 1.125
b $4.5 \leqslant w < 5.5$
2 **a** 2.25 : 1
b £11 358

3



a 31 **c** 45 **e** $\frac{7}{40}$

b Q_3 37, Q_1 23 **d** 23

4 a i $q = p - 5$ **ii** $t = 3x$ **iii** $x = yz$

b $V = 7b$

5 a 6 km **f** $5\frac{1}{2}$ km

b 10 min **g** $8\frac{1}{2}$ min

c $\frac{1}{2}$ km **h** 38.8 km/h (to 1 d.p.)

d 3 km/h **i** 16 km/h

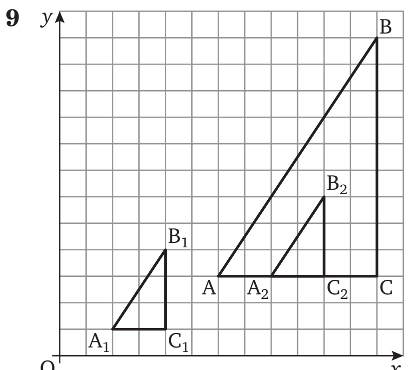
e 4 min

6 a $x = 3, y = -3$ **b** $x = 3, y = -4$

7 a −4, −6 **b** 7, −4 **c** 4, −6

8 D

9



c C_2 (10, 3) **d** (9, 3), scale factor $\frac{1}{3}$

10 QR = 16 cm

Revision exercise 3.5 (p 336)

1 a i 120 m/min **ii** 2 m/s **iii** 7.2 km/h

b i $\frac{11}{20}$ **ii** $\frac{14}{25}$ **iii** $\frac{7}{125}$ **iv** $\frac{11}{2000}$

c $\frac{2}{5}$

2 a $\frac{3}{5}$ **c** $\frac{9}{25}$ **d** $\frac{12}{25}$

3 a £45 **b** £7550

4 a 32 cm and 56 cm **b** 20

5 a $a^2 - 3ab + 2b^2$

b $3x^2 + 7x + 2$

c $p^2 + 2pq + q^2$

6 a $a(a - 3)$ **c** $(x - 7)(x + 7)$

b $(x + 7)(x - 1)$ **d** $(7 - x)(2 + x)$

7 a $r = 2.4$

b 6, 12, 20, 30, … 132

c $5(n - 1)$

d $P = 4y^2 + 10y + 4$

8 a $0, -\frac{4}{5}$ **c** 8, −3

b 8, −7 **d** 3, −4

9 a 9 m² **b** 36 m³ **c** 96 litres

10 EF = 3.125 cm

11 a

Score	67	68	69	70	71	72	73	74
Cum freq	4	11	20	29	35	38	39	40

b 20

c 20

d 69.5

e data not grouped

Mental arithmetic practice 3 (p 338)

1 156 000
2 37
3 1.6 : 1
4 yes
5 yes
6 400 g
7 11 + 13
8 $x(x - 7)$
9 9 kg
10 $\frac{3}{10}$
11 $(x + 5)(x - 3)$
12 $2a$
13 $18a^3$
14 7.5 m
15 0.4
16 $\frac{9}{25}$
17 $7\frac{1}{2}$
18 $(x + 4)(x + 3)$
19 13
20 64
21 F
22 T
23 T
24 F
25 F
26 63.5 kg
27 97.5
28 36
29 0.425
30 10
31 cumulative
32 0.375
33 1 : 0.8
34 $\frac{7}{20}$
35 280 m
36 1.34
37 $(x + 5)(x + 4)$
38 3 million
39 0.027
40 interquartile range
41 $d = c^2 - b^2$
42 10
43 $C = 2(A - B)$
44 $P = 6 - 2r$
45 $2n + 1$
46 0.05
47 $(x + 8)(x - 1)$
48 $z = 3xy$
49 −5
50 $P = R + Q$
51 F
52 F
53 F
54 T
55 F
56 $(a + 3)(a - 4)$
57 $\frac{9}{4}$
58 $5n - 1$
59 $k = \frac{m}{N}$
60 11

Chapter 16 Trigonometry: tangent of an angle

Exercise 16a (p 340)

1 **b** 26.5° **c** 0.5
2 **b** 26.5° **c** 0.5
3 **b** 26.5° **c** 0.5
4 **b** 26.5° **c** 0.5
5 **b** 26.5° **c** 0.5
6 yes
7 **b** 35° **c** 0.75
8 **b** 27° **c** 0.5
9 **b** 37° **c** 0.75
10 **b** 50° **c** 1.2

Exercise 16b (p 343)

1 0.364
2 0.532
3 3.08
4 1.33
5 1.66
6 0.501; drawing is not accurate to 3 s.f.
7 0.277
8 0.568
9 0.202
10 1.74
11 0.0664

Exercise 16d (p 345)

1 5.64 cm
2 5.81 cm
3 0.975 cm
4 4.55 cm
5 1.43 cm
6 5.38 cm
7 14.1 cm
8 5.40 cm
9 7.77 cm
10 3.12 cm
11 7.00 cm
12 5.40 cm
13 4.50 cm
14 7.05 cm
15 6.43 cm
16 6.24 cm
17 16.9 cm
18 3.44 cm
19 9.33 cm
20 10.2 cm
21 5.22 cm
22 3.00 m
23 17.8 cm
24 9.23 cm

Exercise 16e (p 349)

1 5.77 cm
2 4.60 cm
3 3.68 cm
4 5.60 cm
5 8.96 cm
6 6.64 cm
7 9.99 cm
8 14.1 cm
9 34.5 cm
10 3.50 cm
11 17.9 cm
12 126 cm
13 5.10 m
14 69.9 m
15 3.23 cm
16 30.8 cm
17 5.66 m
18 1.40 m
19 **a** 16° **b** 17.2 m
20 **a** 110 m **b** 13.6 m

Exercise 16f (p 353)

1 65.6°
2 19.8°
3 22.3°
4 76.3°
5 54.5°
6 17.2°
7 34.0°
8 44.8°
9 20.6°
10 64.4°
11 45.0°
12 18.4°
13 31.0°
14 38.7°
15 26.6°
16 35.0°
17 8.5°
18 51.3°
19 20.6°
20 66.0°
21 6.8°
22 67.4°
23 18.4°
24 8.1°
25 9.5°
26 39.8°
27 59.0°
28 23.2°
29 12.5°
30 66.8°
31 24.0°
32 53.1°

Exercise 16g (p 354)

1 42.0°
2 33.7°
3 55.0°
4 38.7°
5 36.9°
6 50.2°
7 22.8°
8 59.0°
9 26.6°
10 8.8°
11 33.7°
12 33.7°
13 57.5°
14 36.9°
15 33.7°
16 24.4°
17 63.4°
18 31.8°
19 29.7°
20 59.0°
21 73.3°
22 38.7°
23 47.7°
24 33.7°
25 51.3°
26 30.3°
27 42.5°
28 41.2°

29 56.3°
30 **a** 31.0° **b** 70.0 m
31 26.6°
32 **a** $\widehat{A} = 59.0°$ $\widehat{B} = 62.0°$ $\widehat{C} = 59.0°$
b 11.7 cm
33 56.3°
34 **a** 10.2 km **b** 18.9 km
35 $E\widehat{A}B = 26.6°$, $C\widehat{A}B = 45.0°$, $C\widehat{A}E = 18.4°$
36 3.08 m
37 26.6°
38 **a** 104.4°, 75.6° **b** 5.06 cm
39 15.4 cm
40 **b** 2.61 m
41 138 m

Chapter 17 Sine and cosine of an angle

Exercise 17a (p 362)

1	0.438	**6**	56.5°
2	0.995	**7**	24.4°
3	0.429	**8**	39.7°
4	0.603	**9**	44.7°
5	0.981	**10**	69.6°

Exercise 17b (p 362)

1	8.83 cm	**11**	44.4°
2	6.22 cm	**12**	23.6°
3	1.95 cm	**13**	36.9°
4	1.08 cm	**14**	51.3°
5	6.02 cm	**15**	23.6°
6	2.68 cm	**16**	33.4°
7	2.63 cm	**17**	30.0°
8	2.51 cm	**18**	42.2°
9	9.54 cm	**19**	2.06 cm
10	4.85 cm	**20**	28.2°

Exercise 17c (p 366)

1	0.515	**6**	64.2°
2	0.669	**7**	19.4°
3	0.998	**8**	89.3°
4	0.708	**9**	45.6°
5	0.498	**10**	76.1°

Exercise 17d (p 366)

1	8.48 cm	**9**	53.1°
2	5.07 cm	**10**	68.0°
3	3.75 cm	**11**	38.7°
4	2.68 cm	**12**	32.9°
5	3.08 cm	**13**	60.0°
6	3.22 cm	**14**	41.4°
7	10.2 cm	**15**	63.3°
8	2.78 cm	**16**	56.9°

Exercise 17e (p 369)

1	tan	**13**	36.9°
2	cos	**14**	49.5°
3	sin	**15**	41.8°
4	sin	**16**	61.0°
5	tan	**17**	41.4°
6	cos	**18**	32. 6°
7	tan	**19**	3.06 cm
8	sin	**20**	32.7 cm
9	cos	**21**	0.282 cm
10	sin	**22**	1.09 cm
11	tan	**23**	2.37 cm
12	cos	**24**	320 cm

25 $\widehat{A} = 44.4°$, $\widehat{C} = 45.6°$
26 4.33 cm
27 $\widehat{X} = 71.9°$, $\widehat{Z} = 18.1°$
28 35.3 cm
29 $\widehat{C} = 59.0°$, AB = 166 m
30 12.2 cm
31 13.4 cm
32 41.8°

Exercise 17f (p 373)

1	4.13 cm	**6**	17.0 cm
2	8.72 cm	**7**	4.40 cm
3	23. 3 cm	**8**	14.9 cm
4	4.67 cm	**9**	33.1 cm
5	14.9 cm	**10**	42.6 cm

Exercise 17g (p 375)

1 **a** 8.99 m **b** 8.77 m **c** 39.4 m^2
2 19.5°
3 187 m
4 33.7°
5 52 m
6 209 m
7 **a** 23.4 m **b** 22.0 m
8 **a** 513 m **b** 22 m
9 **a** 62.9° **b** 54.1°
10 15.4 m
11 4.33 cm
12 **b** $x = y \tan 48°$
c $x = (y + 12) \tan 36°$
d The tower is 25.2 m high. The moat is 22.7 m wide.
13 **a** 235 km **b** 128 km **c** 268 km
14 **a** 6.88 cm **b** 172 cm^2
15 **a** 35.2 cm^2 **c** 33.8 cm^2
b 11.6 cm **d** 1.38 cm^2

Chapter 18 Problems in three dimensions

Exercise 18a (p 381)

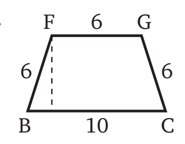
1 **a** 108 cm^2 **b** 160 mm^2 **c** 1650 mm^2
2 3275 cm^2
3 **a** 151 cm^2 **b** 406 cm^2
4 144 cm^2 (3 s.f.)
5 247 cm^2 (3 s.f.)
6 572 cm^2 (3 s.f.)
7 730 cm^2 (3 s.f.)
8 485 cm^2 (3 s.f.)
9 730 cm^2 (3 s.f.)
10 34.6 cm (3 s.f.)

Exercise 18b (p 385)

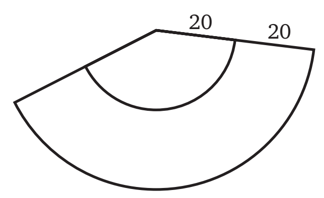
1 **a**

Solid	Number of faces (F)	Number of edges (E)	Number of vertices (V)
cube	6	12	8
tetrahedron	4	6	4
square based pyramid	5	8	5
triangular prism	5	9	6

b $F + V = E + 2$
c 12
2 **a** 804 cm^2 (3 s.f.)
b 283 cm^2 (3 s.f.)
c 561 cm^2 (3 s.f.)
3 **a** 11.7 cm **b** 220 cm^2
4 11 300 cm^2 (3 s.f.)
5 168 cm^2 (3 s.f.)
6 1450 cm^2 (3 s.f.)
7 163 cm^2 (3 s.f.)
8 **a** 6.40 cm **d** 10 cm
b 133 cm^2 **e** 45°, 45°, 90°
c 51.3°
9 **a** 5 cm **b** 6.40 cm **c** 262 cm^2
10 **a** 5.92 cm
b 619 cm^2
c 49 400 cm^2 (4.94 m^2)
11 **a**



trapezium
b 5.66 cm ($\sqrt{32}$)
c 317 cm^2
12 **a**



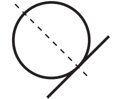
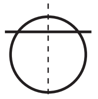
b 1510 cm^2 (3 sf)

Chapter 19 Geometry and proof

Exercise 19b (p 395)

1 the square root of any number between 0 and 1
2 not when $x = 4$
3 Diagonals of a rhombus cut at right angles and a rhombus is a parallelogram.
4 e.g. 40°, 40° and 120°
5 square root step; i.e. $2 - \frac{5}{2} = \pm(3 - \frac{5}{2})$
6 cannot divide by $x - y$ since $x - y = 0$

Exercise 19c (p 397)

1 **a** O moves in a horizontal line 20 cm above the ground.
b 1 point
c 20 cm
d radius, 90°
2

3

4 **b** **i** tangent **ii** 90°

Exercise 19d (p 399)

1 OB = 5 cm, CB = 2 cm
2 $x = 30$
3 **a** 40°
b 50°
4 AB = 12 cm, $\text{O}\hat{\text{B}}\text{A}$ = 22.6° (to 3 s.f.)
5 30°
7 9.80 cm (to 3 s.f.)
8 **a** 19, 23, 29
b **i** $2 \times 3 \times 5 \times 7 \times 11 \times 17 + \frac{1}{13}$
ii $2 \times 3 \times 7 \times 11 \times 13 \times 17 + \frac{1}{5}$
c all the prime numbers between 17 and p
g e.g. 6 469 693 231

Chapter 20 Congruent triangles

Exercise 20a (p 403)

1 yes
2 no
3 yes
4 no
5 need length of a side

Exercise 20b (p 403)

1 yes, sides are equal (SSS)
2 no
3 no
4 no
5 no
6 yes, SSS
7 yes, SSS
8 △ABC = △ACD
9 yes, SSS
10 yes, SSS

Exercise 20c (p 405)

5 triangles 1 and 3 are congruent
6 two triangles

Exercise 20d (p 406)

1 yes, 2 angles and corresponding sides are equal (AAS)
2 no
3 yes, AAS
4 yes, AAS
5 no
6 yes, AAS
7 yes, AAS
8 no
9 yes, AAS
10 yes, AAS

Exercise 20e (p 408)

1 yes
2 no
3 yes
4 no
5 yes

Exercise 20f (p 408)

1 yes
2 no, two possible
3 yes
4 no, two possible
5 yes
6 yes
7 can find the length of the third side in right-angled triangles.

Exercise 20g (p 409)

1 yes, SAS
2 not certainly, angle not included
3 yes, RHS
4 yes, SAS
5 yes, SAS
6 not certainly, angle not included
7 yes, RHS
8 no, angle not included
9 yes, RHS

Exercise 20h (p 411)

1 no
2 yes, AAS
3 yes, SSS
4 yes, AAS
5 no
6 yes, SAS
7 similar, not enough information to say they are congruent
8 yes, AAS
9 yes, RHS
10 yes, SSS
11 yes, AAS
12 similar, not enough information to say they are congruent

Exercise 20k (p 419)

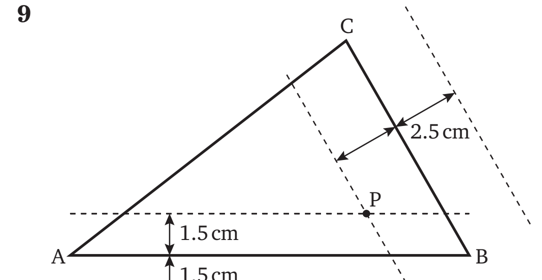
1 AC and BD bisect the angles of the rhombus
2 **a** $A\widehat{E}B = B\widehat{E}C = 90°$
b AE = EC
c BE = ED
3 **b** no
4 **b** AC = DB
5 **a** yes
b no
c midpoint of AC
d angles at E are all 90°
6 no

Exercise 20l (p 422)

1 5 cm
2 5 cm
3 60°

Exercise 20n (p 427)

6 It divides △LMN into two identical triangles.
9



AP = 8.1 cm
10 PB = 4.5 cm
11 CD = 10.3 cm
12 DX = 4.2 cm
13 AD = 7.9 cm

Exercise 20p (p 430)

1 **a** yes, SAS
b no
c yes, RHS
d yes AAS
6 3.4 cm

Summary 4

Revision exercise 4.1 (p 436)

1 **a** 0.424 **b** 1.07 **c** 0.732 **d** 3.25
2 **a** 31.8° **b** 73.6° **c** 53.1° **d** 11.3°
3 10.8 cm
4 **a** 32.0° **b** 51.3° **c** 30.8° **d** 60.4°
5 **a** 12.5 km **b** 18.8 km
6 **a** 0.921 **b** 0.914 **c** 0.678 **d** 0.457
7 **a** 28.3° **b** 22.2° **c** 60.3° **d** 57.1°
8 **a** 55.2° **b** 43.4°
9 **a** BC = 4.77 cm, AB = 7.63 cm
b AC = 19.9 cm
10 **a** 3.84 m **b** 4.87 m

Revision exercise 4.2 (p 437)

1 126 cm^2
2 5.9 cm
3 27.7 cm^2
4 221 cm^2
5 **a** yes, AAS **b** no
7 **a** 76°
8 **a** 6 cm **b** 4 cm
9 $x = 30, y = 60, z = 90$
10 **a** **i** $48\,000\pi$ cm^3 **ii** 48π litres
b 5600π cm^2

Revision exercise 4.3 (p 439)

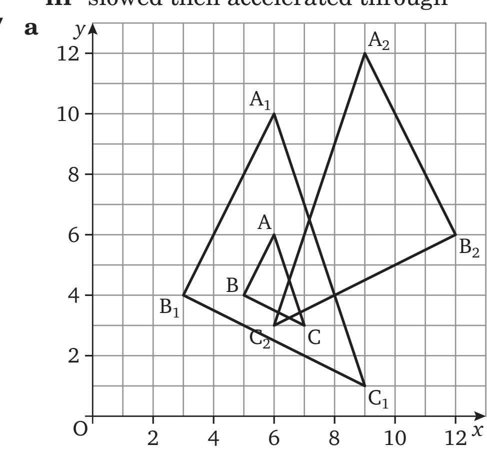
1 **a** **i** 1.48 **ii** 0.773
b **i** 26.2° **ii** 32.0° **iii** 65.0°
c BC = 4.36 cm
2 1.82 m
3 **a** angle A = 32.4°, angle C = 57.6°
b 11.6 cm
4 **a** 11.0 cm
b **i** 15° **ii** 14 cm
5 **a** no, not SAS **c** yes
b yes **d** yes
8 6.93 ($4\sqrt{3}$), 111 cm^2
9 **a** 60° (equilateral △)
b 30° (90° − 60° = 30°)
c 90° (30° + 60°)

Revision exercise 4.4 (p 441)

1 **a** **i** $0.3\dot{6}$ **ii** $0.\dot{6}\dot{3}$
b **i** $\frac{7}{9}$ **ii** $\frac{7}{90}$
c $6\frac{1}{5}$
2 **a** 92.6%
b £69.80
3 **a** $4ab - 12ac$
b $x^2 - 4x - 12$
c $4x^2 + 19x - 5$
d $25p^2 - 4q^2$
4 **a** **i** $a^2(1 + a)$
ii $(x - 7)(x + 3)$
iii $(x + 6)(x + 4)$
iv $(x + y)(x - y)$
b 50.8
5 **a** $5\frac{1}{4}$
b **i** $b = a + c$
ii $x = \frac{(4z + 2y)}{3}$
iii $c = 5(A - b)$
c $n^2 + 4$
d **i** $A = 6\pi r^2$ **ii** $A = \frac{3\pi h^2}{2}$
6 **a** **i** 4, −9 **ii** 0, 3 **iii** 7, 9
b 7
7 **a** **i** 39 cm^2 **ii** 0.0039 m^2
b 0.0117 m^3
8 **b** BD = 3 cm
9 **a** **i** AB = 6.62 cm
ii BC = 10.6 cm
b **i** PR = 9.47 cm
ii QR = 8.44 cm
iii 3.83 cm
10 $\hat{B} + \hat{A}$ (base angles of isosceles △)
$A\hat{C}D = \hat{B} = \hat{A}$ (ext ∠ property of △)
$= 2B\hat{A}C$

Revision exercise 4.5 (p 443)

1 **a** $\frac{30}{365} = \frac{6}{73}$
b $\frac{4}{365}$
c $\frac{30}{365} = \frac{6}{73}$
d $\frac{60}{365} = \frac{12}{73}$
e $\frac{35}{365} = \frac{7}{73}$
leap year so 366 instead of 365 in denominator
2 **a** 84 km **b** 20 litres
3 **a** 4.55 cm **b** 11.4 cm^2
4 **a** variety A: median 13; range 20; iqr 4.8;
variety B: median 10.8; range 20; iqr 5.8
b Variety A tends to be about 2 cm taller and less variable in height.
5 **a** $x = 6, y = 4$ **b** $x = 6, y = -2$
6 **a** A
b **i** slowed to a halt
ii accelerated through
iii slowed then accelerated through
7 **a**



b centre (6, 4); scale factor 3
c A_2(9, 12) B_2(12, 6) C_2(6, 3)
8 **a** 5.27 cm **b** angle A = 35.1°
9 **a** 9 km
b 15 min
c 30 min
d **i** 11 a.m. **ii** 11.30 a.m. **iii** 3.30 p.m.
e **i** 6 km/h **ii** 4.9 km/h
f 4 km/h
g 21 min
h 4.2 km/h
10 **a** 160 cm^2
b **i** 5.66 cm **ii** 8.94 cm
c 71.6°

Mental arithmetic practice 4 (p 446)

1 $c = \frac{1}{3}(2a - b)$
2 56 kg
3 2500 mm^2
4 $\frac{12}{25}$
5 $R = p^2 + q^2$
6 $14b^3$
7 cosine
8 155.5 cm
9 0.33
10 $\frac{100}{9}$
11 £66
12 $x = -5$ or 11
13 49
14 12
15 $3n + 3$
16 £100
17 £84, £36
18 605%
19 $4\pi r^2$
20 (−3, 0)
21 $x \leqslant 8$
22 23, 29
23 tangent
24 equidistant
25 $2a^2 - 15a + 28$
26 $x > -5$
27 tangent
28 40 cm^2
29 octagon
30 17
31 7.7×10^{-1}
32 35 cm
33 10.5
34 1 : 0.75
35 sine
36 63 cm
37 1704
38 $x^2 + 4x - 21$
39 1.2
40 600 cm^3
41 $16\frac{2}{3}$%
42 $\frac{2}{9}$
43 $\frac{1}{5}$
44 60%
45 0.48
46 360°
47 tangent
48 $(x - 6)(x + 3)$
49 27.56 m
50 4
51 20 cm
52 10 000
53 5.5%
54 sine
55 14%
56 T
57 F
58 F (unless the triangle is right-angled)
59 T
60 T